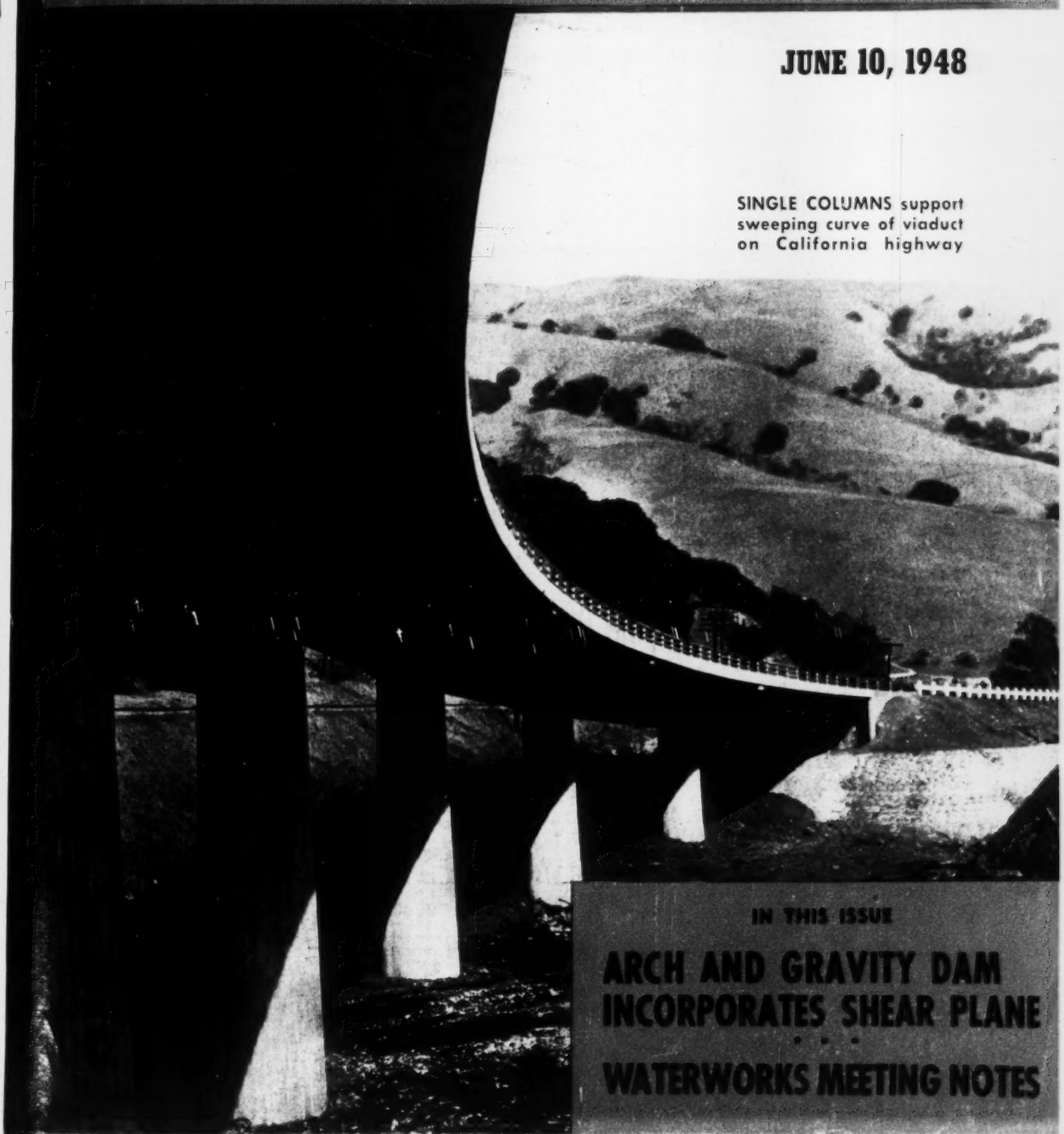
JUL 13 1948

ENGINEERING NEWS-RECORD

A McGRAW-HILL PUBLICATION

JUNE 10, 1948

SINGLE COLUMNS support sweeping curve of viaduct on California highway



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ARCH AND GRAVITY DAM INCORPORATES SHEAR PLANE

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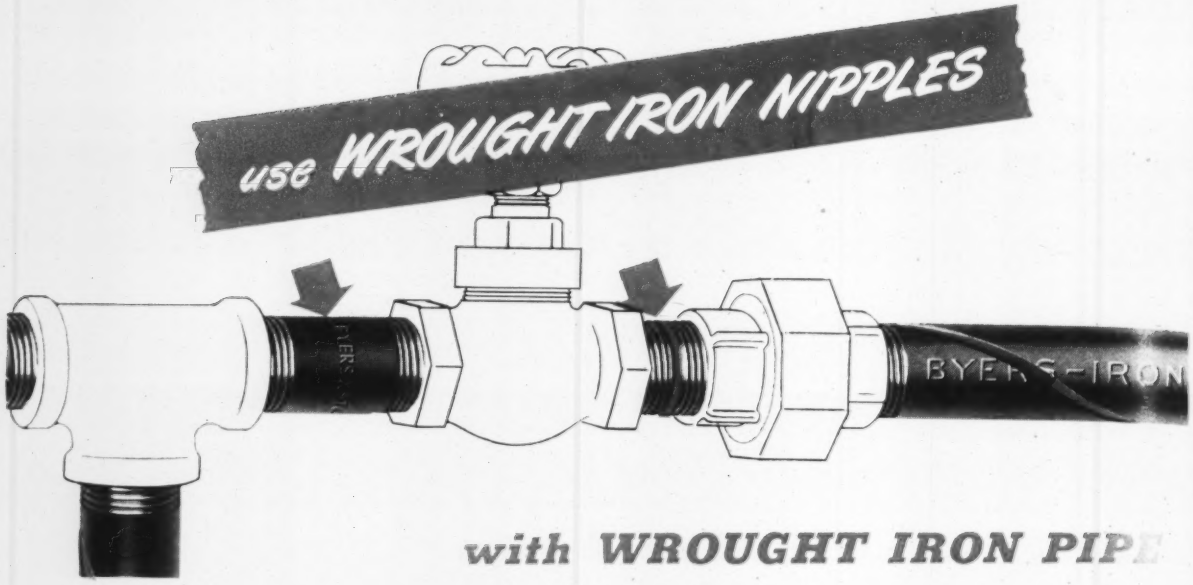
WATERWORKS MEETING NOTES

Avoid "Weak Links" in your piping systems —



with WROUGHT IRON PIPE

When you specify wrought iron pipe to lick some corrosion problem, assure 100% protection by specifying that the pipe nipples also must be wrought iron. Neglect of this simple precaution will leave weak spots in your lines, and set the stage for maintenance headaches.

METHOD OF SPECIFICATION

Merely stating that the piping "system" is to be black or galvanized wrought iron is not enough; the use of wrought iron nipples should be specifically designated. This may be done by requiring that the wrought iron nipples shall be made of pipe conforming to the requirements of A.S.T.M. Specification A72-45, Federal Specification WW-P-441a, Navy Specification 44P11k, or any accredited proprietary specification.

WIDE RANGE OF SIZES

Byers Wrought Iron nipples, both standard weight and extra strong, are available in a wide range of sizes and lengths, either black or galvanized. They are manufactured from new, tested, full-weight wrought iron pipe in accordance with the standards established in the specifications of leading technical organizations. All nipples are furnished with right-hand threads unless otherwise specified; nipples with right and left-hand threads are also available. Nipples are furnished "close" or to length as specified.

IDENTIFICATION

The word "Byers" and the weight —either "Std." or "X Stg." are machine stamped around the circumference of Byers Wrought Iron nipples. On close nipples, where it is impractical to stamp on the threads, a red band is used. These markings provide quick, positive identification of Byers Wrought Iron nipples, and help to avoid any danger of accidental substitution of non-durable nipples in the line.

IN WELDED SYSTEMS USE WROUGHT IRON WELDING FITTINGS

Wrought iron welding fittings are available in a wide range of types and sizes from leading fitting manufacturers. Just contact your supplier.

Wrought iron nipples are also available from a number of manufacturers. The identification used on such nipples may be learned by consulting the supplier.

INHERENT CORROSION RESISTANCE

The superior resistance of wrought iron nipples comes from the unique composition and structure of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

The best guide in applying wrought iron is a knowledge of its character and properties. The complete story is presented in the booklet, "The ABC's of Wrought Iron". Ask for a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

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GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

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Devoted to Buildings, Sewerage, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Airports, Irrigation, Canals, Tunnels, Railroads

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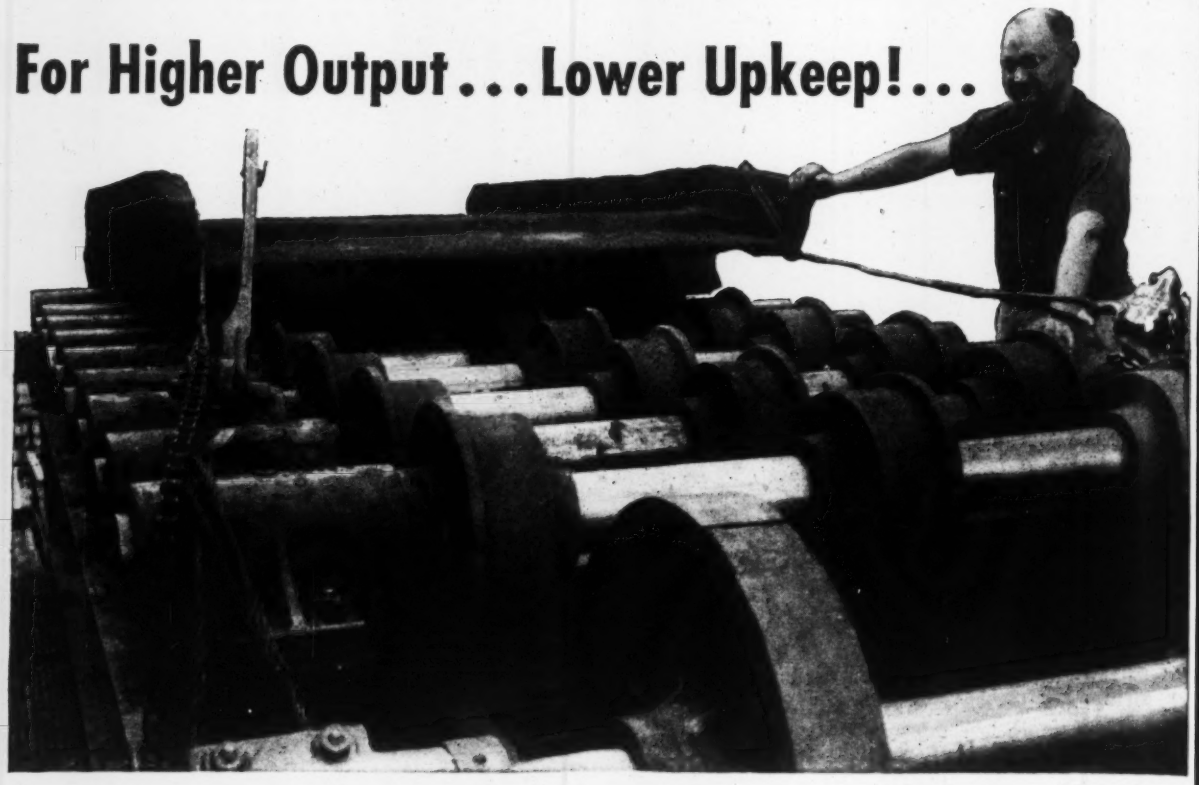

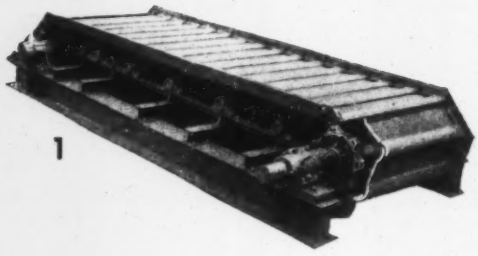

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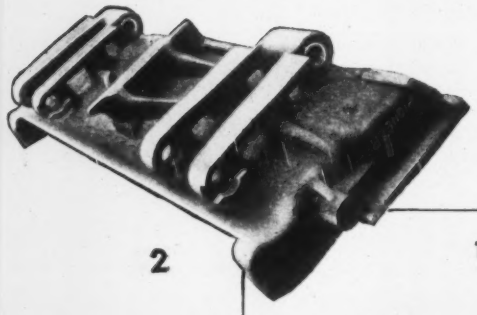


2

When feeding heavy abrasive materials

Iron ore, flintrock, granite, the toughest materials, demand strong, heavy-duty equipment. "Down time" on just one piece of machinery can stop production throughout the entire plant.

For that reason one of the leading mining companies on the Minnesota iron range bought its third PIONEER-ORO Manganese Steel Apron Feeder. Assisting in the installation of this 60" x 16' 3" feeder on the Cuyuna range is C. T. Hendrickson, Pioneer Mines Engineer.

All wearing parts of this heavy-duty feeder are Oro Supermang steel, a superior grade of manganese steel. Head sprockets are equipped with replaceable Supermang teeth; tail sprockets, with Supermang pads to reduce link wear and keep maintenance to a minimum.

If you're handling tough, abrasive material, write for information about PIONEER-ORO Manganese Steel Apron Feeders. Our new folder will give you complete details.

PIONEER ENGINEERING WORKS

1515 Central Avenue **Minneapolis 13, Minnesota**

1. PIONEER-ORO FEEDERS are now available in four widths: 36", 42", 48" with nine inch pitch; the 60" feeder has 15 inch pitch.

2. To save maintenance. Links are cast as part of the pan. Non-turning alloy steel connecting pins fit in Supermang non-turning, replaceable bushings in the link eyes.

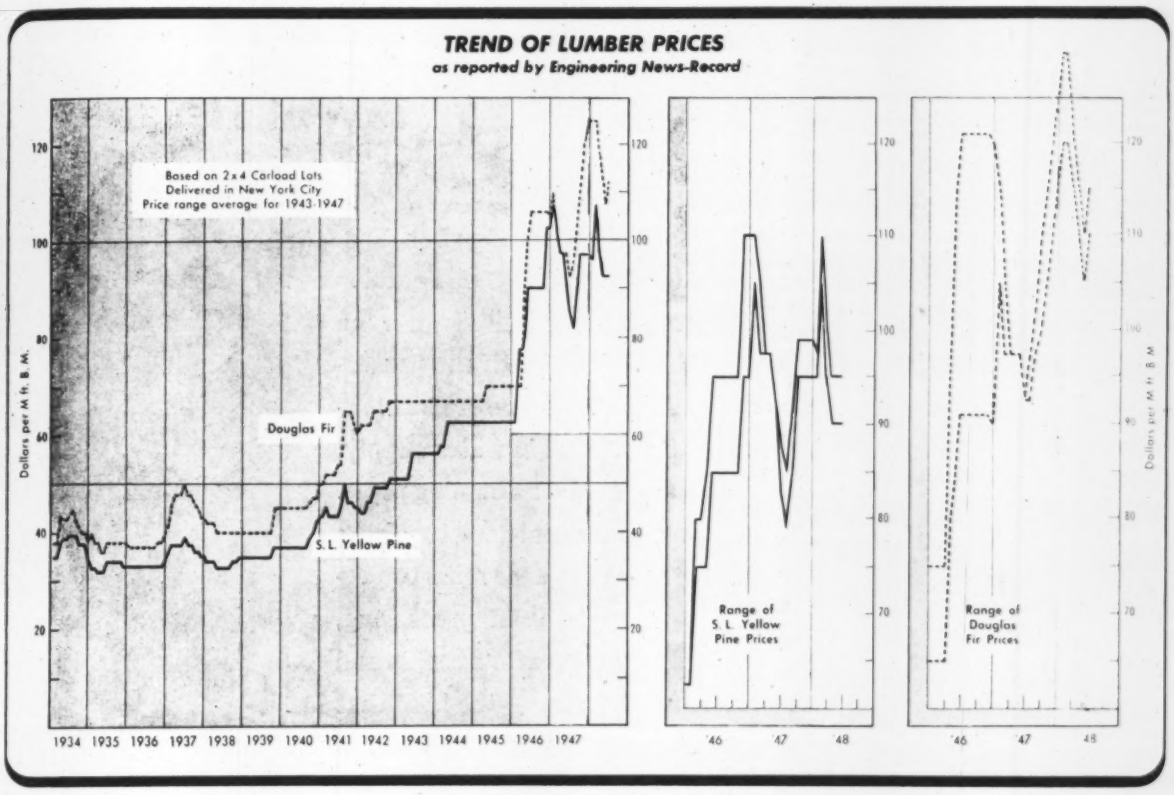
BUY BOTH—

Higher Output, Lower Upkeep!

Pioneer

Continuflo **EQUIPMENT**

CONSTRUCTION TRENDS


TREND OF LUMBER PRICES
as reported by Engineering News-Record
Based on 2x4 Carload Lots
Delivered in New York City
Price range average for 1943-1947
Douglas Fir
S. L. Yellow Pine
Dollars per M ft. B. M.
1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947
Range of S. L. Yellow Pine Prices
Range of Douglas Fir Prices
'46 '47 '48

June Rise in Lumber Prices Reverses Three-Month Decline

June wholesale lumber prices for the United States as a whole advanced to $96.93 per M ft. bm. for 2x4 Douglas Fir from $96.16 in May and to $88.91 for 2x4 short leaf Yellow Pine from the May average of $88.77, according to *Engineering News-Record's* 20-cities average. This is a reversal of the downward trend evident since February during which period the U. S. price average dropped approximately $2 per M ft.

The recent advance in lumber prices can be attributed to a revival of the demand as the result of increased activity brought on by the warm weather. Four of the twenty cities reporting to *Engineering News-Record,* Boston, New York, Kansas City and San Francisco, showed gains in June. Boston lumber prices increased $3.50 per M board feet on the average, New York prices, $2.50, Kansas City prices, $1.50 and San Francisco prices, $4.50.

Average Douglas Fir prices for the United States are now up again within a $1.03 of the all-time peak of $97.96 reached in February of this year, and Yellow Pine is still $2.33 below the February peak of $91.24. There is a strong possibility that lumber price average will continue to rise as the current increase is reflected in additional cities.

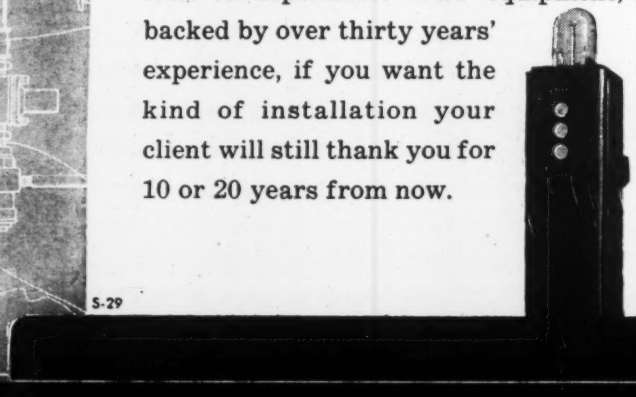
An increase in the demand for lumber is expected, since *Engineering News-Record's* physical volume index of heavy engineering construction contract awards shows an increase of 24 percent in the March-May period over the three preceding months, and an increase of 18 percent over the corresponding three-month period of 1947.

The accompanying chart shows the trend of 2x4 Douglas Fir and short leaf Yellow Pine prices in New York City from 1934 to date. This trend is characteristic of other U. S. cities but in varying degrees. New York short leaf Yellow Pine prices rose to $92.50 M board feet in June 1948 from $62.50 in January, 1946, a gain of 48 percent. Douglas Fir prices in New York rose to $112.50 in June from the January 1946 average price of $70, or 61 percent. For the corresponding two-and-a-half-year period, the U. S. average short leaf Yellow Pine price showed an increase of 63 percent and the U. S. average Douglas Fir price, 76 percent.

You can't see the most important item

QUALITY isn't listed on the assembly drawing; but it *is* built into every W&T Chlorinator. It's there because neither you nor we want to take chances with the protection of public health — one of chlorination's important roles in water supply, sewage treatment and swimming pools. In their many industrial uses, too, from controlling slime in paper mills to preventing spoilage in food processing, you'll find this same craftsmanship and careful manufacturing — the kind that keep W&T chlorinators on the job economically year after year.

So when chlorination is indicated look to dependable W&T equipment, backed by over thirty years' experience, if you want the kind of installation your client will still thank you for 10 or 20 years from now.



WALLACE & TIERNAN
COMPANY, INC.
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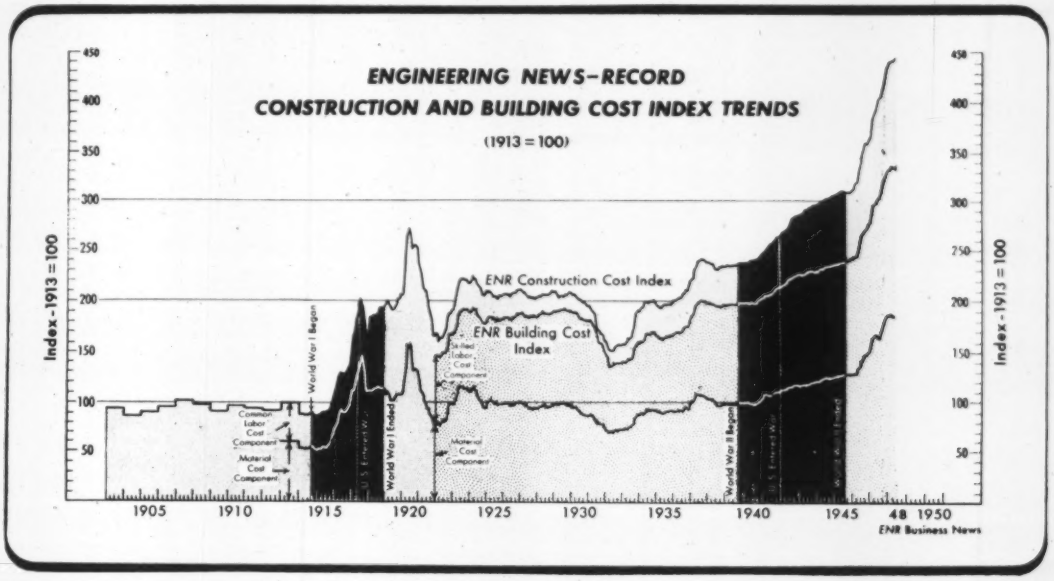
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

JUNE CONSTRUCTION BUSINESS REPORT



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	May 1947 (5 wk.)	May 1948 (4 wk.)	% Change	Five Months 1947 (22 wk.)	Five Months 1948 (22 wk.)	% Change
Total U. S. Construction	$514,343	$535,184	+30	$2,156,690	$2,737,037	+27
Private Construction	282,328	247,018	+9	1,290,526	1,293,540	+0.2
Public Construction	232,015	288,166	+55	866,164	1,443,497	+67
Federal	72,642	64,522	+11	226,117	468,916	+107
E N R Construction Volume Index, 1913 = 100	222	258	+45	214	242	+13
Total New Productive Capital	173,404	324,096	+134	691,568	1,548,522	+124
Private Investment	173,404	324,096	+134	691,568	1,548,522	+124
Federal (non-federal work)						
Federal (federal work)						

CONSTRUCTION COSTS . . . WAGE RATES . . . MATERIAL PRICES

1913 = 100	June 1947	June 1948	% Change	1947 May	1947 June	% Change	1948 May	1948 June	% Change
				Change May to June					
E N R Constr. Cost Index†	406.63	455.80	+12.09	399.98	406.63	+1.66	447.86	455.80	+1.77
E N R Building Cost Index†	307.42	339.26	+10.36	304.64	307.42	+0.91	333.93	339.26	+1.50

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$1.185	$1.352	+14.09	$1.140	$1.185	+3.95	$1.315	$1.352	+2.81
Skilled Labor (Av. 3 Trades)	2.015	2.250	+11.66	1.940	2.015	+3.87	2.180	2.250	+3.21
Bricklayers	2.175	2.406	+10.62	2.078	2.175	+4.67	2.343	2.406	+2.69
Structural Ironworkers	2.004	2.268	+13.17	1.943	2.004	+3.14	2.192	2.268	+3.47
Carpenters	1.867	2.075	+11.14	1.799	1.867	+3.78	2.006	2.075	+3.44
Cement, bulk, per barrel	2.51	2.82	+12.35	2.51	2.51	0.0	2.81	2.82	+0.36
Structural Steel, base	2.50	2.75	+10.00	2.50	2.50	0.0	2.75	2.75	0.0
Sand, per ton	1.777	1.958	+10.19	1.768	1.777	+0.51	1.951	1.958	+0.36
Lumber, 2x4 Fir, per M ft	87.53*	96.93	+10.74	88.46*	87.53*	−1.05	96.16	96.93	+0.80
Lumber, 2x4 Pine, per M ft	80.67*	88.91	+10.21	83.47*	80.67*	−3.35	88.77	88.91	+0.16
Common brick, per M	22.85	25.700	+11.25	22.83	22.85	+0.09	25.375	25.700	+1.28
Ready-mixed concrete, c.y.	8.934	9.951	+11.38	8.829	8.934	+1.19	9.951	9.951	0.0
Struct. clay tile, 3x12x12	109.48	123.13*	+12.47	108.05	109.48	+1.32	123.13*	123.13	0.0

* *Revised.*

MATERIAL SHIPMENTS . . . BUILDING PERMITS

	May 1947	May 1948	% Change	April 1948	% Change Apr. to May
Steel (% operating capacity) A.I.S.I., weekly average	94.1	94.4	+0.3	80.6	+17.1

	March 1947	March 1948	% Change	Three Months 1947	Three Months 1948	% Change
Cement, thous. bbl. U. S. B. of Mines	12,133	13,957	+15.0	28,962	31,500	+8.8

	April 1947	April 1948	% Change	Four Months 1947	Four Months 1948	% Change
Fabricated Structural Steel, tons, A.I.S.C.	157,392	149,341	−5.1	571,967	604,289	+5.7
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$228,173	$364,428	+59.7	$786,867	$1,225,344	+55.7

COST OF LIVING INDEX . . . . EMPLOYMENT

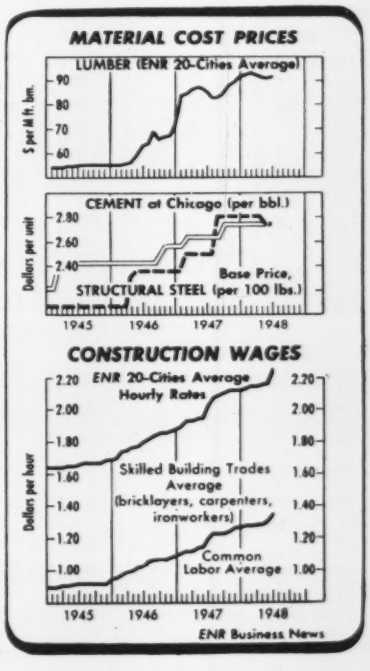
Base 1935–39 = 100	1941	April 1947	April 1948	% Change	March 1948	% Change Mar. to Apr.
Consumers' Price Index, B L S	105.2	156.2	169.3	+8.4	166.9	+1.4
Rent (Housing) Index, B L S	106.2	109.0	116.3	+6.7	116.3	0.0

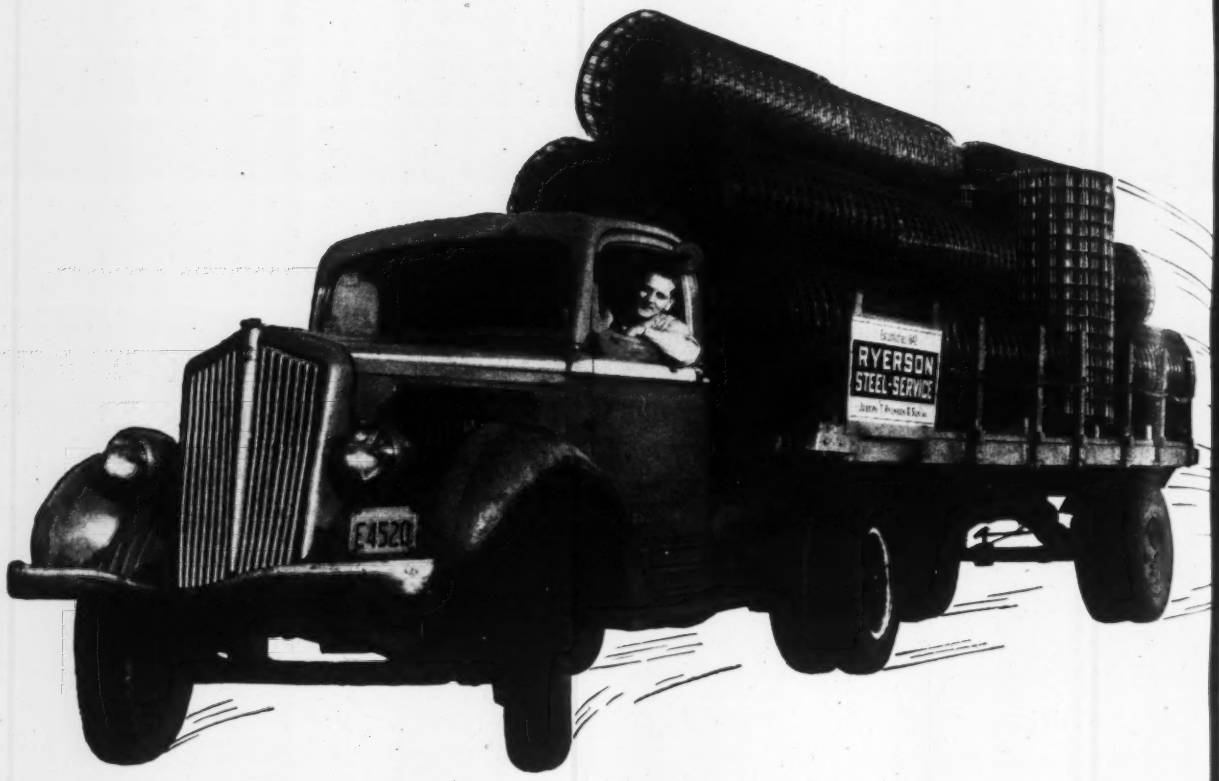
	April 1947	April 1948	% Change	March 1948	% Change Mar. to Apr.
Contract Constr. Employ. (est.), thous., B L S	1,619	1,790	+10.6	1,627	+10.0

ENR INDEX NUMBERS*

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
June, 1948	455.80	219.10	339.26	183.39		
May, 1948	447.86	215.29	333.93	180.51	258	113
Apr., 1948	443.64	213.26	334.56	180.85	302	132
Mar., 1948	443.60	213.24	334.22	180.67	247	108
Feb., 1948	442.67	212.79	335.49	181.36	231	101
Jan., 1948	441.65	212.30	333.58	180.32	173	76
Dec., 1947	441.13	212.05	333.06	180.04	246	108
Nov., 1947	436.91	210.02	329.22	177.97	234	103
Oct., 1947	434.58	208.90	327.29	176.92	228	100
Sept., 1947	426.38	204.96	322.58	174.38	250	110
Aug., 1947	422.85	203.26	317.75	171.77	211	93
July, 1947	413.75	198.89	308.90	166.98	218	96
June, 1947	406.63	195.47	307.42	166.18	274	120
May, 1947	399.98	192.27	304.64	164.68	222	97

The 1947-1948 revision of the ENR Construction and Building Cost Indexes, published last month in *Engineering News-Record* resulted from a field recheck of Boston and Cleveland lumber prices.





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These large, diversified stocks mean you can get fabric that exactly meets your job requirements. And Ryerson service also includes engineering help. We gladly recommend the correct size and gauge to give necessary strength at lowest cost.

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STRUCTURALS—I Beams, H Beams, Channels, Angles, Tees, etc.
PLATES—Including Inland 4-Way Floor Plate
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TUBING — Seamless & Welded Mechanical & Boiler Tubes
REINFORCING STEEL—Bars, Spirals, Expanded Metal, etc.
STEEL FORMS—for Concrete Joist Construction
CHAIN, Wire, Wire Rope, etc.

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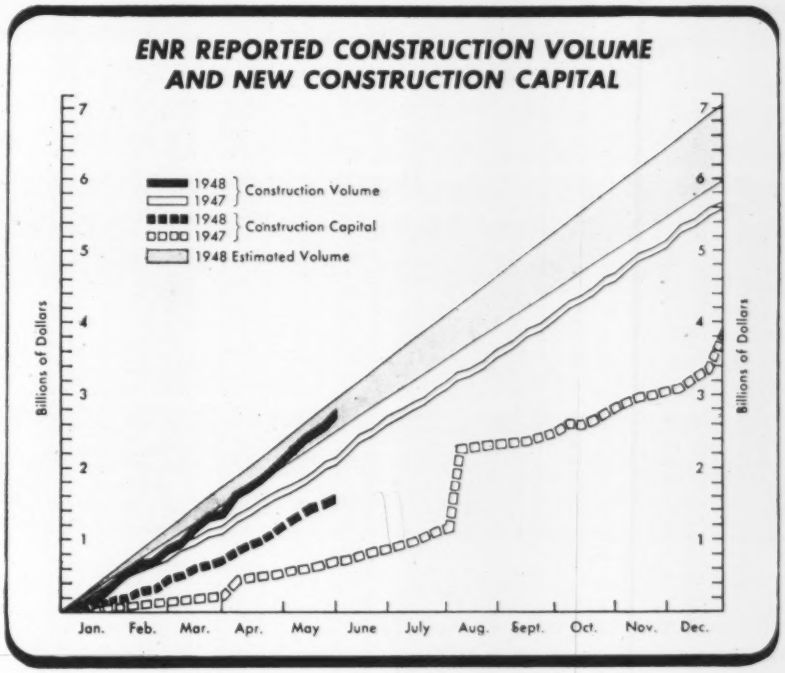
RYERSON STEEL

New Construction Volume in May

Civil engineering construction volume in continental United States totals $535,184,000 for May, an average of $133,796,000 for each of the four weeks of the month. This average is 14 percent below the weekly average for April, 1948 but 30 percent above the average for May, 1947, according to *Engineering News-Record's* construction contract awards.

Private construction for May on a weekly average basis is 21 percent below last month and 9 percent above last May. Public construction is 7 percent below last month but 55 percent above May, 1947. State and municipal construction is 3 percent above last month and 75 percent above the average for May, 1947. Federal construction, down 30 percent from last month, is 11 percent above May, 1947.

Weekly averages in the various classes of construction for May, 1948 compared with April, 1948 show gains in waterways of 182 percent; highways, 17 percent; and commercial buildings, 26 percent. Losses are recorded for industrial buildings of 57 percent; public buildings, 9 percent; earthwork and drainage, 36 percent; sewerage, 55 percent; public bridges, 28 percent; public unclassified, 43 percent; and private unclassified, 21 percent.


ENR REPORTED CONSTRUCTION VOLUME
AND NEW CONSTRUCTION CAPITAL
1948 } Construction Volume
1947 }
1948 } Construction Capital
1947 }
1948 Estimated Volume
Billions of Dollars
Billions of Dollars
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Geographically, the Middle Atlantic section showed a gain of 31 percent in May, 1948 over April. New England dropped 15 percent; South, 40 percent; West of the Mississippi, 25 percent; Middle West, 48 percent; and Far West 3 percent.

Four sections made gains in May over May, 1947—Middle Atlantic, 165 percent; New England, 3 percent; Far West, 32 percent; and South, 8 percent. Middle West dropped 14 percent and West of the Mississippi, 15 percent from last year.

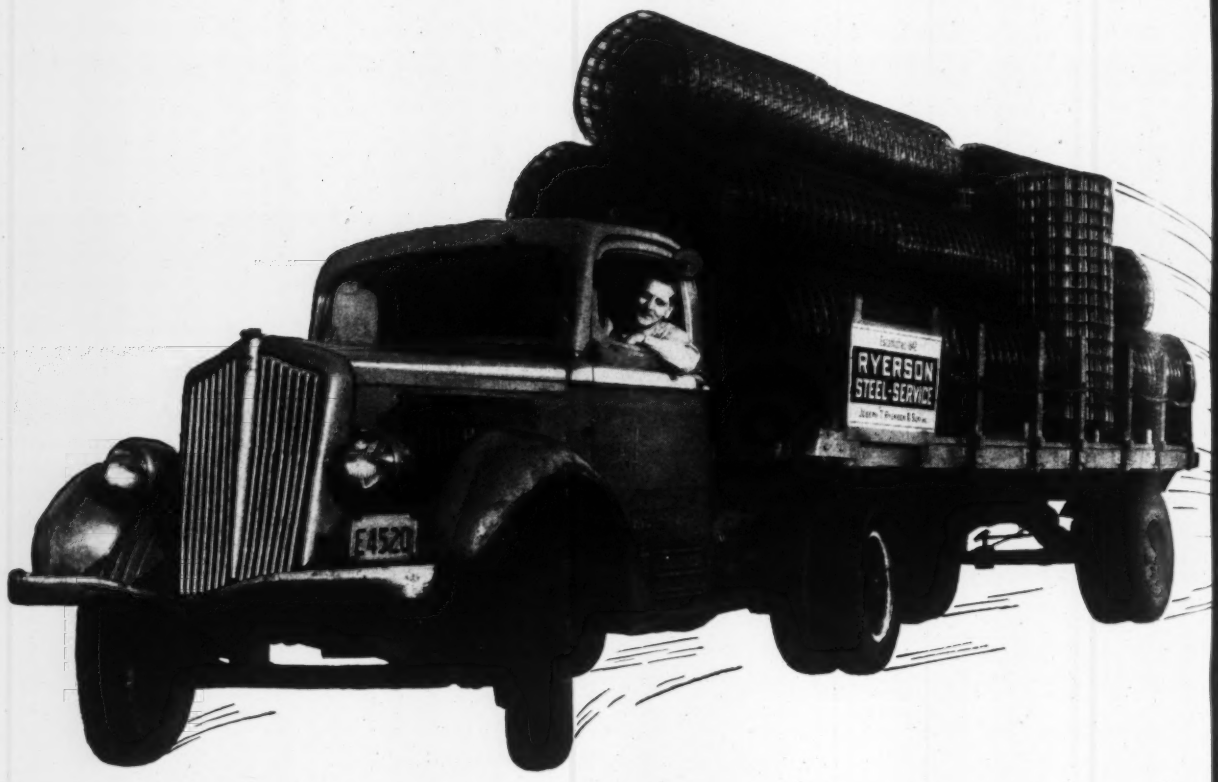
New capital for construction for the four weeks of May, 1948 totals $324,096,000, or a weekly average of $81,024,000 for the month. The weekly average is thus 9 percent below the weekly average of $89,368,000 for April, 1948 but 134 percent above the weekly average of $34,681,000 for May, 1947.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD — MAY, 1948

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs — Waterworks, excavation, drainage and irrigation*, $28,000; *other public works* $50,000; *industrial buildings*, $68,000; *other buildings*, $250,000

Four Weeks—Thousands of Dollars (000 Omitted)

Public works	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States May 1948	United States Five Months 1948	United States Five Months 1947	Canada
Waterworks	.....	25,824	2,649	2,330	3,041	1,899	35,743	92,211	50,172	61
Sewerage	.....	2,870	2,184	1,517	2,664	2,932	12,167	87,082	44,371	3,981
Bridges, public	2,013	3,631	2,782	1,664	4,354	2,310	16,754	112,324	63,686	174
Earthwork and waterways	112	704	13,932	706	6,708	11,792	33,954	245,134	104,820	612
Streets and roads	4,969	19,619	15,427	12,092	35,102	13,068	100,277	385,337	292,831	2,582
Buildings, public	309	36,079	11,588	11,889	7,648	9,946	77,459	432,401	210,204	14,946
Unclassified, public	250	2,052	3,138	732	2,103	3,537	11,812	89,008	100,080	3,046
Total public	**7,653**	**90,779**	**51,700**	**30,930**	**61,620**	**45,484**	**288,166**	**1,443,497**	**866,164**	**25,402**
Federal government (included in above classifications)	365	20,300	16,521	947	9,844	16,545	64,522	468,916	226,117	.....
Private										
Bridges, private	.....	.....	.....	.....	400	.....	400	800	463	.....
Industrial buildings	11,566	13,884	7,449	11,349	15,448	14,767	74,463	400,831	338,678	6,175
Commercial buildings	4,758	96,564	8,915	6,566	24,908	22,457	164,168	799,355	758,065	2,435
Unclassified, private	149	620	1,552	1,244	3,491	931	7,987	92,554	193,320	.....
Total private	**16,473**	**111,068**	**17,916**	**19,159**	**44,247**	**38,155**	**247,018**	**1,293,540**	**1,290,526**	**8,610**
Total Engineering Construction:										
May, 1948 — 4 weeks	**24,126**	**201,847**	**69,616**	**50,089**	**105,867**	**83,639**	**535,184**	.....	.....	**34,012**
April, 1948 — 5 weeks	35,338	193,238	145,366	119,514	176,163	107,540	777,159	.....	.....	30,017
May, 1947 — 5 weeks	29,227	96,409	80,277	73,224	155,871	79,335	514,343	.....	.....	33,992
Five Months — 1948	**127,435**	**803,512**	**468,479**	**296,549**	**654,836**	**386,226**	.....	**2,737,037**	.....	**151,383**
Five Months — 1947	92,261	533,706	360,814	290,744	486,720	392,445	.....	.....	2,156,690	173,270



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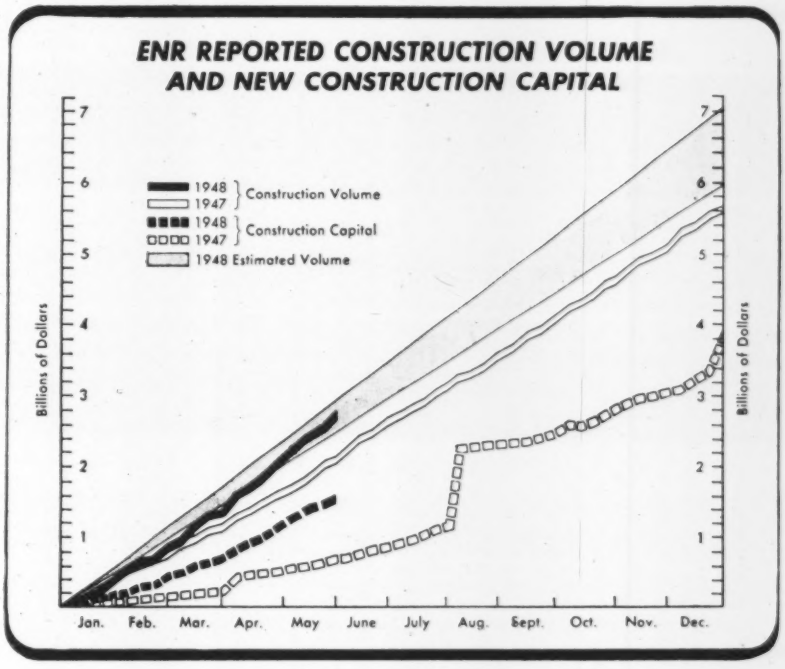
New Construction Volume in May

Civil engineering construction volume in continental United States totals $535,184,000 for May, an average of $133,796,000 for each of the four weeks of the month. This average is 14 percent below the weekly average for April, 1948 but 30 percent above the average for May, 1947, according to *Engineering News-Record's* construction contract awards.

Private construction for May on a weekly average basis is 21 percent below last month and 9 percent above last May. Public construction is 7 percent below last month but 55 percent above May, 1947. State and municipal construction is 3 percent above last month and 75 percent above the average for May, 1947. Federal construction, down 30 percent from last month, is 11 percent above May, 1947.

Weekly averages in the various classes of construction for May, 1948 compared with April, 1948 show gains in waterways of 182 percent; highways, 17 percent; and commercial buildings, 26 percent. Losses are recorded for industrial buildings of 57 percent; public buildings, 9 percent; earthwork and drainage, 36 per-



tic section showed a gain of 31 percent in May, 1948 over April. New England dropped 15 percent; South, 40 percent; West of the Mississippi, 25 percent; Middle West, 48 percent; and Far West 3 percent.

dropped 14 percent and West of the Mississippi, 15 percent from last year.

New capital for construction for the four weeks of May, 1948 totals $324,096,000, or a weekly average of $81,024,000 for the month. The weekly average is thus 9 percent below the weekly average of $89,368,000 for April, 1948 but 134 percent above the weekly average of $34,681,000 for May, 1947.

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IG NEWS-RECORD — MAY, 1948

aterworks, excavation, drainage and irrigation, $28,000; *ngs*, $250,000

	United States			
ar	May	Five Months		
est	1948	1948	1947	Canada
899	35,743	92,211	50,172	61
932	12,167	87,082	44,371	3,981
310	16,754	112,324	63,686	174
792	33,954	245,134	104,820	612
068	100,277	385,337	292,831	2,582
946	77,459	432,401	210,204	14,946
537	11,812	89,008	100,080	3,046
484	288,166	1,443,497	866,164	25,402
545	64,522	468,916	226,117	.....
...	400	800	463	.....
767	74,463	400,831	338,678	6,175
457	164,168	799,355	758,065	2,435
931	7,987	92,554	193,320	.....
155	247,018	1,293,540	1,290,526	8,610
639	535,184	.....	.....	34,012
540	777,159	.....	.....	30,017
335	514,343	.....	.....	33,992
226	.....	2,737,037	.....	151,383
445	.....	.....	2,156,690	173,270

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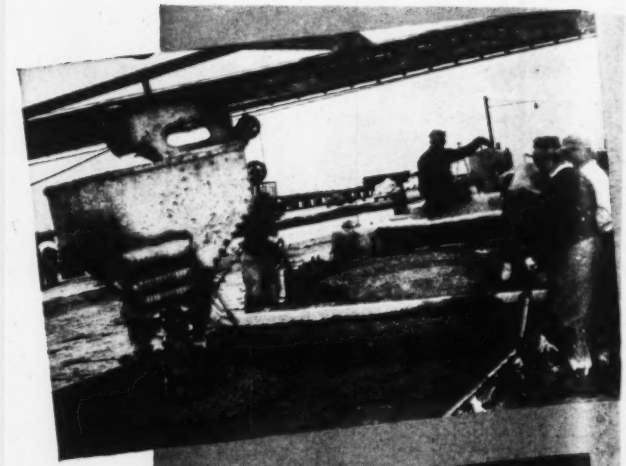

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News of the Week

ENGINEERING NEWS-RECORD • JUNE 10, 1948 • VOLUME 140 • NUMBER 24

Wide World photo

POURING THROUGH—Floodwaters of the Columbia River pour through a break in a railroad embankment, to inundate the war-housing settlement of Vanport, part of Portland, Ore.

Pacific Northwest rivers near record flood stages

Rivers of the Pacific Northwest had receded slightly from peak flood stages at the end of last week, after going on their costliest rampage in history to pile up damages estimated in the hundreds of millions of dollars.

The Columbia River, with its many tributaries in Oregon, Idaho and Washington, was the center of the flood damage, but the Fraser River in Western Canada also went out of its banks, for a time cutting off the city of Vancouver, B. C., from land communication with the outside world. As the week ended, reports of new flood crests on the Snake River—chief Columbia tributary—were issued by U. S. Weather Bureau observers. It was believed that the new crest would very closely approach, but not exceed previous peaks.

At the peak of the flood, the Columbia registered a flow of 1,030,000 cfs. at Portland, Ore.—not far under the all-time record of 1,170,000 cfs. recorded in the great flood of 1894. The river crested at 30.3 ft. at Portland—12.3 ft. above normal flood stage.

Along the tidal section of the Columbia, which extends to above Portland, there is a wide valley floor which is subject to flooding when the river flow reaches 600,000 cfs., although little damage results until the flood exceeds 700,000 cfs. In this tidal area, about 127 sq. mi., made up of small farms, is not protected by levees, while 117 sq. mi. is more or less protected by dikes, including much of the low land near Portland.

All dams built to date on the Columbia are primarily for power and navigation—not for flood control. Bonneville, which is closest to Portland, provides no storage. Grand Coulee has a reservoir 115 miles long, with a usable storage for power and irrigation of 5,028,000 acre-ft., but it was full when the floods came.

Columbia flood details

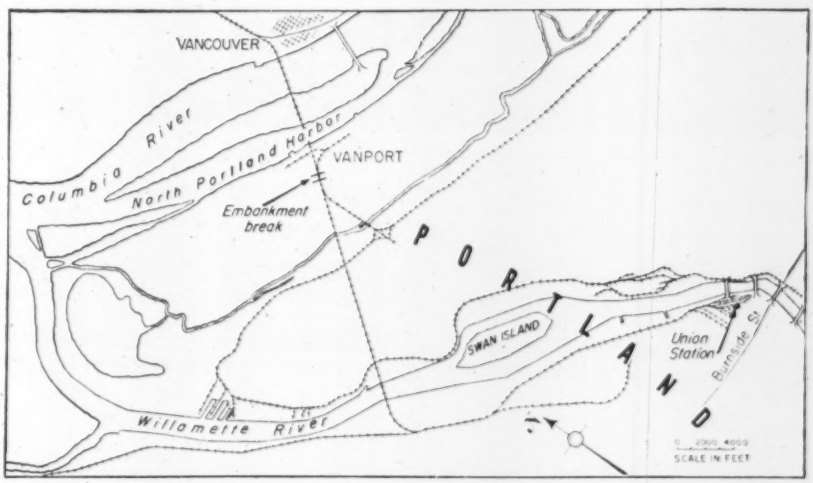
The sudden rise in the Columbia and its tributaries started about May 24 when warm rains melted heavier-than-normal snows in the mountains near the river's headwaters.

Towns in central Idaho, western Montana and eastern Washington were immediately affected, as tributary streams swelled out of their normal banks. The St. Joe River broke through dikes in three places near St. Maries, Idaho, and residents of riverside towns to the west turned out every available man and piece of equipment in an attempt to save river control works.

The greatest tragedy of the flood—from the standpoint of loss of life and property—came on May 31, when the pressure of the river water broke through a railroad embankment at right angles to the river's course at Portland, and inundated the populous Vanport housing development, almost completely destroying housing accommodations for some 18,000 persons and causing an undetermined loss of life.

The break occurred in a fill built in

(*Continued on page 72*)



CITY FLOOD AREA—Downtown sections of Portland, Ore., cut by the Columbia and Willamette rivers, were under water for blocks as the two rivers rose to near-record flood stages. A housing colony at Vanport was virtually destroyed.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

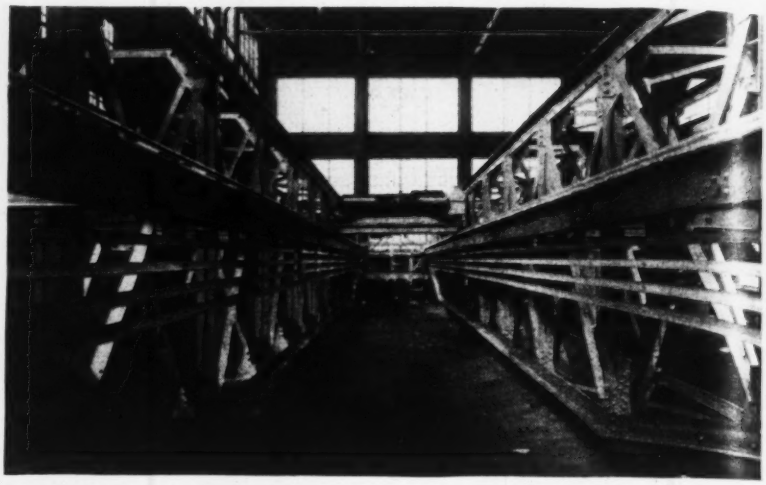
Housing—Discoll and Davis Development Co. of Fort Smith, Ark., are planning a 44-acre subdivision at *Henryetta, Okla.* . . . The Minister of National Defense announces a $20,000,000 housing program calling for the completion of 2,350 dwellings for veterans in *Canada* this year . . . Genrich Builders, Inc., Buffalo, N. Y., has started a subdivision in *Snyder, N. Y.* to consist ultimately of 350 homes . . . B. J. Brous has started a 3,000-home project in *Massapequa Park, L. I., N. Y.* . . . A $5,000,000 housing program has been agreed upon between *St. Laurent, Que.*, and the Central Mortgage and Housing Corp. . . . Plans are in hand for a 101-unit project at *Pocatello, Idaho*, to be built by J. R. Simplot, Boise. . . . Jacob Freidus is building a $2,500,000 development at *Long Beach, N. Y.*, to be called Drake Homes . . . Parkway Terrace, a $4,000,000 garden apartment project at *Suitland, Md.*, near Washington, D. C., is now under construction. San Minskoff & Sons, New York are the contractors.

Highways—A legislative road study committee in *Iowa* has received recommendations for nearly a billion dollars worth of state highway improvements over the next 15 years. . . State Senator Lister Anderson of *Nebraska* says his state needs to spend at least $300,000,000 to "get out of the mud" . . . Commissioners of *Marion County, Ind.*, will resurface 150 miles of county roads this summer . . . Park crews used 7,000 lbs. of explosives, including 150 cases of TNT, to clear snow from highways through mountain passes in *Yellowstone National Park, Wyo.* . . . The state roads commission of *Maryland* has agreed to build an access road costing $1,800,000 to connect the Baltimore International Friendship Airport with Baltimore-Washington Freeway . . . The provinces of *Canada* have made these appropriations for 1948 road construction: Nova Scotia, $9,073,528; Quebec, $24,000,000; Ontario, $57,000,000; Manitoba, $5,579,000; Sackatchewan, $7,189,000; Alberta, $10,858,280; and British Columbia, $18,600,000.

Industrial Construction — Allied Chemical & Dye Corp. is planning a $1,000,000 plant on a 29-acre site on the River Road, *Buffalo, N. Y.* . . . Costing about $2,000,000, a large skating rink is to be built at *Cincinnati, Ohio* for Cincinnati Gardens, Inc. It will have a seating capacity of 11,000 for hockey games. A. M. Kinney Inc., are the architects and engineers, and Bevington, Taggert & Fowler are the rink designers. General contractors are Frank Messer & Sons, Inc.

Public Construction —It is expected that construction will start this year on the hospitals at *Alexandria Bay, Canton* and *Gouverneur, N. Y.*, to be built by the Edward John Noble Foundation. Total cost will be $12,500,000 . . . A two-story brick and reinforced concrete science building is to be erected at the Eastern Montana Normal School at *Billings*. Boespflug Const. Co. has the general contract at $256,038 . . . A joint $2,015,126 general construction contract has been let to Kucharo Const. Co., Des Moines, Iowa, and Johnson, Drake & Piper Co., Minneapolis, Minn., for the Iowa state office building at *Des Moines*.

Sewers and Water Supply — *Indian Hill, Ohio*, Cincinnati suburb, is studying the advisability of building its own $1,000,000 waterworks. . . . At least six syndicates are expected to submit bids for the first one-third of the $17,750,000 in water and sewerage improvement bonds for *Tulsa, Okla.* . . . *Billings, Mont.*, will receive bids June 15 for the second phase of its $700,000 sewer improvement program.



LIGHT-HEAVY CLASS—Capable of lifting 15 tons, structural members of this new heavy duty crane are made entirely of high strength aluminum alloy. Girder span is 97 ft. According to the Dominion Bridge Co., Ltd., which fabricated the crane, the weight of a standard crane of this size would have been 94,000 while the weight of the aluminum machine is 51,700 lb. Due to this considerable saving in weight, a lighter than normal motor is used and reduction in weight of supporting steelwork was also found possible. Strength of aluminum alloy used is approximately the same as that of structural steel, but in order to prevent excessive deflection it was necessary to increase the depth of the girders.

Buffalo Army engineers move into new office

For the first time in seven years, the various departments of the Buffalo, N. Y., office of the U. S. Corps of Engineers are housed in a single building. The consolidation was achieved when the engineers took possession of the district's new building at the foot of Bridge St., Buffalo.

The moving from offices in Ellicott Square started last April. New one-story frame structure provides office space for a staff of 350, and also houses a machine shop, garage, storehouse, carpenter and electrical shops and other specialized centers.

R. F. Boger named ENR publisher

Robert F. Boger, who has been associated with the McGraw-Hill Publishing Company since 1928, has been named publisher of *Engineering News-Record* and *Construction Methods*.

Mr. Boger succeeds A. E. Paxton, who has been named Western District Manager and Regional Vice-President for the company, with headquarters at Chicago.

During his long service with the company, Mr. Boger has been associated with a number of the McGraw-Hill publications, including those in the mining and aviation fields. He is also publisher of *Aviation Week*.

Senate highway-aid bill changes seen endangering funds for states' roads

Committee revisions of House-approved measure forecast stormy passage as Congressional session nears end

Washington, D. C. Drastic amendment of the House federal-aid highway bill (H. R. 5888), as reported out by the Senate Public Works Committee last week, poses differences that can cause controversy on the Senate floor and in the conference committee which will have the job of reconciling the House and Senate versions for final action by both bodies. Unless the bill can gain agreement and support at all stages of the process before Congress closes shop on Saturday, June 19, the states face the prospect of shelving some of their federal-aid highway plans for the fiscal year 1950.

State programs necessarily are laid out several years in advance. Preliminary engineering and right-of-way acquisition take time and money. Until Congress has committed the federal government to highway aid for the years ahead, the state road departments cannot invest their current funds in these necessary preparations.

Important amendments by the Senate committee range from major cuts in money and time allowances to changes in formulas for use of federal-aid funds. These and other less important alterations can produce all kinds of argument between conflicting interests.

Amount of aid cut

In point of money, the most serious reduction is a cut in federal aid to the states from $500,000,000 to $400,000,000 per year, with a shortening of the period of authorizations from three years to two for the fiscal years 1950 and 1951. Of great importance, too, is that the period of grace in which authorizations remain available for obligation is reduced from three years to one year after the year for which the funds are authorized.

This provision allows the states a total of 2½ years, or slightly more, in which to make use of the apportioned funds for any one year. Apportionment of authorized funds for the 1950 fiscal year, for example, must be made before Jan. 1, 1949. The states then would have until June 30, 1951—a period of 30 months—in which to obligate the apportioned funds.

As an aid to states that have not been able to commit all of the federal-aid funds from the Highway Act of 1944, the Senate committee extended the grace period for these funds an additional year, making it three years instead of two. The two-year period itself is now in effect by amendment of the 1944 act, which originally allowed a grace period of only one year.

Interstate network favored

The distribution among the highway systems remains the same: 45 percent for primary, 30 percent for secondary, and 25 percent for urban (*ENR* March 25, vol. p. 451), but, as a new feature that marks a departure from the traditional 50-50 cost-sharing principle, the Senate committee's version attempts to stimulate work on the National System of Interstate Highways by authorizing the federal government to pay 60 percent of the cost of projects on this national network.

Actually, of funds so far committed to primary and urban systems under the Federal-Aid Highway Act of 1944, 30 percent has gone to the interstate network, which comprises at present some 37,000 miles (or 16 percent) of the 231,000-mile primary system. The Senate committee wants to see an even larger proportion of funds used on the interstate system, and it was willing to give up the 50-50 matching formula to attain the desired effect.

One of the Senate committee amendments would direct the Public Roads Administration to study and report to Congress by April 1, 1949, the status of the National System of Interstate Highways with particular respect to national defense needs.

Funds for forest highways

Forest highways also come in for changes in the revised bill. Administration of forest-highway funds is transferred to the PRA. These highways would receive direct authorizations of $20,000,000 per year for fiscal years 1950 and 1951, in contrast to the House authorization of $25,000,000 a year for three years.

For forest trails and development roads, the committee version authorizes $20,000,000 per year for two years, instead of $12,500,000 for three years as in the House bill.

To take care of mounting PRA costs, the Senate committee added to the bill an amendment increasing the allowance for administrative expense and research from 2½ to 3¾ percent of federal-aid authorizations.

PERSPECTIVE . . . .

Tractors Abroad

Of a total of 37,600 track-type tractors shipped by U. S. manufacturers in 1947, about 25 percent (9,649, to be exact) went for export. On a dollar basis, domestic shipments amounted to nearly $100,000,000, and export shipments to more than $35,000,000, according to the Industry Division of the Bureau of the Census.

However, U. S. tractor shipments under foreign aid programs represent only a small part of the total exported in 1947. The real reason for shipping tractors abroad at a time when the home demand outruns the supply is that manufactures are trying to hold markets for the future. They are attempting to spread their shipments equitably in order to maintain foreign demand for U. S. machinery, against the day when output will exceed full domestic requirements plus present overseas allotments.

Domestic shipments of tracklaying tractors in 1947 included [illegible],000 for non-farm uses, and 9,000 for agriculture. Of the track-type tractors exported, 7,100 were for industrial uses and 2,500 for farms.

Six manufacturers supplied the tracklaying tractors. A large number—18—made wheel tractors. Shipments of wheel tractors in 1947 totaled 420,000 units, with a value of more than $342,000,000. Of 348,000 wheel tractors shipped to U. S. users, less than 13,000 went to industrial purposes other than agriculture. Exports of wheel tractors took 21 percent of the total number of units shipped and accounted for 18 percent of the dollar volume.

Tractor production in 1947 outstripped 1946 for both types. Both reached all-time highs.

The export ratios for both types of tractors are expected to remain about the same in 1948. Foreign shipments under the "Marshall Plan" will put no added demand on tractor manufacturers. Sales to these countries will be made as before, through established trade channels. . . . *V. B. S.*

Map by Wide World

FLOOD AREAS—Tributaries of the Columbia River overflowed their banks in three states as quick-melting snows forced the streams to abnormal highs. The Fraser River in British Columbia cut off the city of Vancouver from communication with the rest of Canada, by washing out highways and rail lines.

Northwest rivers near record floods

(*Continued from page 69*)

1907 by the Spokane, Portland and Seattle R. R. Some time after its construction the fill was connected to a system of dikes protecting low-lying river lands to the north of Portland, these dikes being connected to the fill. Railroad company officials, admitting responsibility for maintaining the fill, insisted that it was maintained as a fill, not as a dike.

To outward appearances, the railroad fill was the strongest part of the diking system. It was 40 to 50 ft. wide across the top, and had greater freeboard than any dike in the area. It gave way, however, as workers were strengthening dikes along the river front proper, and inundated the entire housing development.

Other flood damage along the Columbia included an estimated $1,000,000 in damage to buildings and farmlands at Bonners Ferry, Idaho. About $100,000 damage to Kittitas County, Ore., highways and bridges was caused by the Yakima River. Total damage to highways, railroads, buildings and farmlands in the three-state area was placed by state authorities at more than $100,000,000.

Fraser river floods

In southern British Columbia, local authorities said the Fraser River had caused the worst damage in history, and although records were not immediately available, officials expected the river to equal 1894 flood records.

Great development in farming along the lower river valley added to the high damage costs. The Trans-Canada highway was flooded out near Vancouver, and both the Canadian Pacific and Canadian National railroad main lines were broken by washouts, so that Vancouver (a city of 300,000 persons) was entirely cut off from land communication with the rest of Canada.

Abnormally high water levels were aggravated by the failure of many small dams and protective dikes along the Fraser and its tributaries.

The flood along the Fraser Valley continued to remain serious as a new week opened. Although the water level did not rise further, more dikes were breached and new areas were flooded.

Some communications had been restored by June 7, when the two transcontinental rail-lines announced they would operate trains as near to Vancouver as possible, and use buses and trucks for the remaining distance.

An immediate result of the floods was the aggravation of an already acute housing situation, as some 30,000 persons forced to leave river-front dwellings sought other accommodations. Sanitary authorities also issued repeated warnings of possible pollution of municipal water supplies, and boil water notices were posted.

Use short wave radio for Missouri Basin work

Army engineers have activated a short wave radio network to provide emergency communication facilities throughout the Missouri River basin, an announcement said last week.

Principal receiving and sending stations are located at the Fort Peck, Mont., Garrison, N. D., Kansas City and Omaha district offices, with other stations set up at area offices within the districts.

The network is for use in time of flood, storms and other disasters that may interrupt normal communication channels.

Three midwest states study flood control

The Tri-State Soil and Water Council of the Maumee Valley, organized recently (*ENR* Jan. 1 vol. p. 10) to encourage soil conservation and flood control in Indiana, Ohio, and Michigan, will hold its first meeting for state committees on June 25, at Napoleon, Ohio.

Each of the three states will name a general committee to consider individual state problems, and each committee will elect four delegates to serve on a tri-state executive committee. The latter group will coordinate soil and conservation activities and sponsor an educational program. Ohio has 15 counties, Indiana, five, and Michigan three in the 23-county watershed.

Kanopolis Dam ready; first Pick-Sloan project

Kanopolis Dam, the first major flood control dam and reservoir unit of the Missouri Basin program was dedicated May 31.

The three-mile long compacted earth dam, rising 131 ft. above the Smoky Hill River bed, marks a milestone in the long efforts of people of the 529,000-sq. mi. Missouri River basin to control its vast river system and put the water to work for the public good.

First authorized by Congress in the Flood Control Act of 1938, the Kanopolis project was designed primarily for flood control on the Smoky Hill and Kansas Rivers. Work was started in December, 1940, but was halted in 1942 by the war. It was resumed soon after the ending of hostilities, with the first postwar in April, 1946. It is one of 105 reservoirs included in the basin program for flood control, irrigation and production ultimately of 10,000,000,000 kwh. of electricity annually.

Army approves plan for better use of technical specialists in military units

Program provides special units in organized reserve for use of skills of engineers and scientists

Under the terms of a new order approved by the Department of the Army, engineers and scientists will be given a special designation to provide for the best possible use of their skills in research and development work. This is to be done by the establishment of organized-reserve officer groups, one of which has already been formed in Wilmington, Del. It is understood that a similar procedure is under consideration by both the Navy and the Air Force.

Details of the program were presented before the Committee on Sanitary Engineering and Environment of the National Research Council, which met in Washington on June 2. The development is an outgrowth of a survey among professional men who served in World War II that revealed, in the words of a reviewing committee, "a dangerous wastage of the technical skills of scientific personnel in military service."

The survey, which covered members of thirty professional societies representing nine scientific fields, showed that only 30 percent of those who replied felt that their talents had been utilized to the fullest extent. Another third reported that their services were fully used for only half their period of military activity, and the remainder claimed little or no use of their special qualifications in the army.

The committee that reviewed the survey and made recommendations for the adoption of the new policy by the Department of the Army was composed of reserve officers. Civil engineers were represented on the committee by William N. Carey, executive secretary of the American Society of Civil Engineers.

Details of program

The new program, incorporated in Circular No. 127 of the Army, was drafted under the sponsorship of Maj. Gen. A. C. McAuliffe, deputy director for research and development, Logistics Division of the Army general staff. This provides that in any area where there are a minimum of 20 reserve officers professionally engaged in research and development, the formation of an organized unit may be requested. Subgroups, attached to a larger unit, may be organized where the available men in a given area number less than 20.

Eligibility will be determined on the basis that an applicant must hold at least a bachelor's degree from an accredited college and be engaged in a professional capacity in a field of activity associated with one of the physical, engineering, medical or biological sciences.

Civilians who seek a reserve officer's commission in order to participate in the program will have opportunity to do so. Regulations are now being drafted setting forth required qualifications. In certain cases, age-limit and physical requirements may be waived in order to accommodate and encourage the activity of men of special technical competence.

During peacetime, reserve officers participating in the program will be given inactive duty status. Their training will include: Orientation in research and development work of the Army; work on selected problems; review and editing of technical manuals; evaluation of proposed techniques; and providing assistance in formulation of service-school training programs.

Should the need for mobilization occur, the reserve officers will be given assignments to appropriate Army research and development installations or offices.

The new program is designed particularly to attract the interest of demobilized officers who have not continued their affiliation with the Organized Reserve Corps because of: (1) Lack of a program in which their scientific skills would be used; and (2) a fear that in event of another mobilization their experience would again be misused.

It is also recognized that the present international situation requires speed in planning, organization and utilization of the scientific potential of the nation.

In addition to the Wilmington, Del. group already functioning under the direction of Brig. Gen. Norman M. Lack, commanding officer of the 199th Organized Reserve, R. & D. other groups are in the process of organization in Philadelphia, Pittsburgh, the University of Illinois, Urbana; Georgia Institute of Technology, Atlanta; Lehigh University, Bethlehem, Pa.; Pennsylvania State College, State College, Pa.; and in New York City and Boston. Complete details of the program may be obtained by addressing Maj. S. C. Rothmann, Logistics Division, GSUSA, room 4D831, Pentagon Bldg., Washington 25, D. C.

Mississippi appoints new road, flood control body

The appointment of a 12-man highway planning committee to devise a complete farm-to-market road system for Mississippi has been announced.

A flood control study committee, authorized by the 1948 legislature, has also been named. Its study, to center around the 24 counties comprising the Yazoo River Basin watershed.

West extension studied for Penn Turnpike

Three possible routes for extension of the Pennsylvania Turnpike from its present western terminus east of Pittsburgh in a northwesterly direction to the Ohio line are now being studied by the Pennsylvania Turnpike Commission. One route lies to the south of Pittsburgh, and west of that city would be in the same area as the westerly extension of the Penn-Lincoln Parkway, design studies for which are now under way. The two other routes run north of the city in the general direction of Youngstown, Ohio.

Location surveys for this extension are being made by Gannett, Fleming, Corddry & Carpenter, engineers, of Harrisburg, which firm made the surveys for the eastern extension to Philadelphia and is now making detailed designs for part of that extension. Aerial surveys were made by the Aero Service Corp.

Indiana and Kentucky confer on bridge cost

Construction of a proposed $2,000,000 toll bridge across the Ohio River at Lawrenceburg, Ind., came a step closer recently when Garrett L. Withers, Kentucky commissioner of highways, and three Kentucky highway engineers conferred with members of the Indiana State Highway Commission engineering staff. They discussed Kentucky's share of the cost of building an approach on the Kentucky side of the river. Unofficially that share has been placed at from $210,000 to $225,000.

Traffic surveys on the Indiana side of the proposed bridge indicate the bonds for construction could be repaid in 10 years, after which the bridge would be toll free.

Kentucky engineers accompanying Withers were Dwight Bray, chief highway engineer; H. R. Creal, assistant chief engineer, and Tom W. Johnson, administrative assistant.

Housing need seen acute for low income group

Contradicting claims of real estate groups that the housing shortage is artificial, mayors and public housing officials from about 20 cities presented figures last week to prove that the need for housing is real in low and middle income groups.

The inability of private enterprise to furnish a solution to the housing problem thus far was stressed in the opening panel of the Institute of Housing and Planning Studies, held June 2 to 4 in New York City. Sponsored by the New York State Division of Housing, the meeting consisted of over a dozen panels in which eminent authorities discussed such topics as problems of housing; reducing the cost of the small home; new construction methods, equipment, materials and mechanical systems; prefabrication; economic trends; mortgages and public housing.

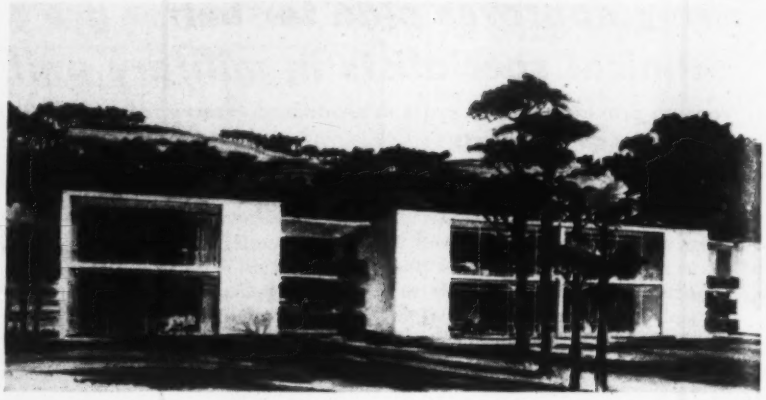
Costs under fire

In the panel on the problems in housing, the mayors of several New York State cities pointed out that in their communities since 1940 population has grown and new families have been formed at a much faster rate than housing has been built. Furthermore, they said, most of what has been constructed has been for sale, whereas most families prefer to rent. In many cases, slum clearance and highway projects have had to be postponed because of the inability to find new homes for persons who would be displaced.

Other speakers saw a partial solution to the housing problem in reducing the cost of the small home. In discussing methods of achieving this, the various authorities pointed to economies that could be attained through mass production, packaged parts and more efficient site development.

Two resolutions were passed by the panel on new construction methods. They urged "liberal and enlightened financial assistance by the Federal government through the FHA to permit increased production and acceptance of the pre-engineered home." Also that "research funds be made available by the Federal government in order to develop, investigate and test materials and methods of construction intended for use in homes and multi-family housing."

In the discussion of cost trends, it was the consensus that construction costs were leveling off. However, some speakers thought that the recent Supreme Court decision holding the basing-point pricing system illegal was a blow to stabilization of the industry.



ATOM HOUSING—To provide for workers and their families at its Oak Ridge, Tenn., plants, the U. S. Atomic Energy Commission recently received a low bid of $8,686,000 for construction of 450 multiple-family garden apartments such as this. The buildings will provide from one to three bedrooms, enclosed or screened porches, and separate entrances to each apartment. Low bidder was Merritt, Chapman and Scott, of New York City. Skidmore, Owings and Merrill are architect-engineers.

Researchers check new school building methods

A joint research project is to be launched shortly to investigate the newest requirements and methods of design and construction of public school buildings, the American Institute of Architects and the Producers' Council said last week.

The U. S. Office of Education will also cooperate in the work, the joint announcement said.

Walter A. Taylor, director of the Department of Education and Research of the A. I. A., pointed out that with the exception of housing, the largest volume of needed construction is in public school buildings. "Most of the present school building types," he added, "have been rendered more or less obsolete."

W. F. Rockwell heads manufacturer group

Willard F. Rockwell, board chairman of Rockwell Manufacturing Co., Pittsburgh, Pa., has been elected president of the Water and Sewage Works Manufacturers Association, his tenure of office to start next Jan. 1. He is now vice-president and a member of the board of governors of the association. He has also been re-elected to the board of directors of the American Water Works Association.

Officers and directors of both associations were named at a combined meeting held in Atlantic City, N. J., during the recent annual convention of the American Water Works Association.

Canada makes a record in home construction

A survey has been completed by the Central Mortgage and Housing Corp. of Ottawa, Ont., which shows that more homes were constructed in Canada during 1947 than in five other principal countries.

Canada's housing accomplishment in 1947 was 63 houses per 10,000 population as compared with government-compiled figures that show 62 houses per 10,000 population built last year by the United States, 61 by New Zealand, 59 by Sweden and 48 each by the United Kingdom and Australia.

New college buildings planned in Montana

Plans for a new business and education building on the Montana State university campus at Missoula and for an administration building at Northern Montana college at Havre have been approved by the state board of examiners.

The Missoula building, for which $300,000 has been appropriated, will be of reinforced concrete, faced with brick. It will be a 3-story structure, with 26,000 ft. of floor space.

The Havre building, a 2-story structure designed so that two additional stories may be added when funds are available, will be of reinforced concrete with brick facing to provide earthquake and fire resistance. A total of $400,000 has been appropriated for the project.

Fred Brinkman of Kalispell, Mont., is architect for both buildings.

Court okays unions' right to strike

Building trades workers in the Reno, Nev., and eastern California area this week retained their right to maintain a closed shop and to strike.

Following a day-long hearing at Carson City, Federal Judge Roger Foley lifted a temporary restraining order and refused to grant an injunction under the terms of the Taft-Hartley Act.

The restraining order had been issued earlier at the request of the Reno Employers Council in cooperation with the California Association of Employers. It was directed at 17 allied building trades unions which for the last few weeks had been negotiating for wage increases up to 25 cents an hour.

Although no strike had been indicated, the employers groups asked for and obtained the restraining order a few hours before the unions' contract expired. As a result, work in the building trades continued without interruption under the terms of the old contract, while the contesting parties awaited the court's decision.

The employers' groups had sought to have the restraining order prolonged by issuance of a preliminary injunction. Judge Foley said he is powerless to issue such an injunction. He cited a case between the federal government and the United Mine Workers in which the Supreme Court ruled that the district court has the power to maintain existing conditions.

Representatives of the employers groups said one of the chief purposes in asking the restraining order was to determine whether the building trades unions are subject to the Taft-Hartley Act regulations. That relationship was not definitely settled in the decision rendered by Judge Foley.

Following the lifting of the restraining order, representatives of the building trades unions said negotiations with the employers will continue. They expressed no intention to strike.

Order election for technical men

A panel of the National Labor Relations Board in New York City ordered an election to determine representation of technical employees of a general contractor.

The case involved the technical employees of Starrett Brothers & Eken, Inc., and Architectural & Engineering Guild, Local No. 66, of the International Federation of Technical Engineers, Architects and Draftsmen's Unions, an AFL affiliate. The union claims to represent employees of the contractor and sought a unit comprising all technical engineering employees employed on the Peter Cooper Village project, including chiefs of party, instrument men, front chain-men, computers, engineering division estimators and others. Although the employer did not object to the requested unit, it refused to recognize the petitioning union as the exclusive bargaining representative until the union had been certified by NLRB.

The panel decision affirmed the employer's contention that commerce was affected within the meaning of the National Labor Relations Act.

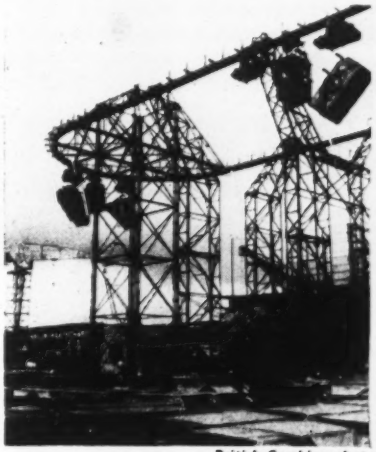
Other developments

At Buffalo, N. Y., the 28-day strike of AFL building trades unions was ended by the 15 crafts involved, and work was resumed on June 1. The Hodcarriers and Common Laborers remained away from work, however. The agreement gave the crafts, with the exception of truck drivers, a 25 cent an hour increase originally asked.

Under agreements completed with the Master Builders' Association and contractors engaged in highway construction and similar work, five St. Louis, Mo. AFL unions have been granted wage increases of from 10 to 35 cents an hour in the St. Louis area.

Heads of all San Diego city departments have been granted a 10 percent salary increase by the city council, as were all other city employees not covered by civil service regulations.

At Milwaukee, Wis., members of the Building Trades Employers Association met to discuss the problem of labor pirating which they charge has raised hourly rates for skilled workers far above existing scales and threatened a sharp increase in building costs.



British Combine photo

DUTCH TREATMENT—In place of the familiar covered garbage trucks used in U. S. cities, the Amsterdam, Holland, Municipal Cleansing Service uses small covered barges to bring garbage through the city's maze of canals to a disposal plant. A monorail system picks up the closed sections of the barges and dumps them in an incinerator for disposal.

Chances that the requirement for union shop authorization elections might be discontinued in the near future are dead.

The Senate-House joint Taft-Hartley "Watchdog" committee, concluding three weeks of hearings on various proposals to amend the law, has decided not to drop the union shop election rule at this time. This means no change is in sight before next year, if then.

The next pilot election in the building and construction industry is being planned for Detroit. The Detroit election, involving a variety of contractors, will be considerably more complicated than the first test election held among employees of western Pennsylvania roadbuilders last month.

Approve design of St. Louis memorial arch

The $40,000 first prize design for the riverfront memorial at St. Louis, Mo. (*ENR* March 4, vol. p. 338) featuring a monumental arch has been approved unanimously by the United States Territorial Expansion Commission, national body having charge of the historic development.

Unlicensed contractor injunction denied

Judge Luther Hamilton in Superior Court at Carthage, N. C., has denied a request of the North Carolina State Board for Licensing Contractors for an injunction requiring a county board of education to halt construction of a school building. The state board charged the local body with violation of the state law by failing to employ a licensed contractor on a public building costing $10,000 or more.

The Moore County school board contended that it cannot be forced to employ a licensed contractor in the event of an emergency when the lowest bid of a contractor is considered exorbitant. The building in question is to replace one destroyed by fire in March, 1947, and is being erected by a county construction crew for around $200,000.

Asks $52 million a year for Louisiana roads

Louisiana's new director of highways, R. B. Richardson, has recommended that the state legislature appropriate at least $52,000,000 a year for construction and improvement of highways. The total is in addition to the $27,000,000 which now is received by the highway department in dedicated funds.

In a letter to Gov. Earl K. Long, it was pointed out by Mr. Richardson that the funds recommended included $10,000,000 for farm-to-market roads; $12,500,000 for black-topping rural roads; $5,000,000 for deferred maintenance; $10,000,000 for primary road repairs, $5,000,000 in unmatched federal funds, and $10,000,000 to meet the annual cost of matching federal funds.

Louisiana maintains 15,000 miles of state roads, which is 48 percent of its total mileage.

Construction begins on Augusta bridge

Construction began this week on the foundation and superstructure of the $2,500,000 Kennebec River toll bridge at Augusta, Me., which will provide a second crossing at the Maine capital.

Total length of the project is 4100 ft., including 2092 ft. for the bridge. A 28-ft. roadway and two 6-ft. sidewalks will be carried on eleven spans, including five deck arch trusses. The largest truss is to be 350 ft. long. For river navigation, a 67-ft. width of channel, with a clearance of 74.4 ft. at mean low water, is provided.

W. H. Hinman, Inc., of North Anson, Me., holds the $376,921 substructure contract and the American Bridge Co. will build the superstructure for $1,063,655.60.

Plan equipment school at ARBA's road show

As part of its program in construction education, the education division of the American Road Builders Association will conduct a four-day equipment seminar for students and educators at the annual Road Show at Chicago.

Starting Monday, July 19, sessions will be held at the Stevens Hotel from 9:30 until noon, to cover one particular class of equipment each day through lectures and films. The afternoon sessions will include a tour of the exhibits to inspect and study the equipment items covered in the corresponding morning sessions.

U. S.-Canada commission studies river pollution

In the first tour of its kind since 1912, members of the International Joint Commission recently boarded a U. S. Engineers' vessel at Buffalo for an investigation of pollution in the Niagara River.

This was the latest step in an extensive examination of all phases of existing or threatened pollution, in all connecting waters from the outlet of Lake Superior to the mouth of the Niagara River. The investigation was begun two years ago under the terms of the Waterways Treaty of 1909.

New York City inspects aqueduct after 20 years

For the first time since 1928, New York City shut down its 80-mi. Catskill aqueduct recently to check for needed repairs and to determine if the aqueduct's capacity can be increased.

During the shutdown, reserve supplies held in the Kensico reservoir about 30 miles north of the city were used. The 16-ft. diameter tunnel which normally carries 630 mgd. to the city was emptied in 8 hours.

At the same time, laboratory technicians went into the aqueduct to gather samples of slime deposits and the mortar lining from selected locations. Slime samples will be analyzed for chemical and biological content in an attempt to learn the cause of the deposits, mortar particles will be checked to determine what change, if any, has taken place in the composition.

Pennsylvania to build five flood control dams

Governor James H. Duff of Pennsylvania has allocated $5,900,000 from a legislative appropriation for construction of five combination flood control and recreation dams.

Construction work will be handled by the State Department of Forests and Waters. The projects are: Little Pine Creek, Lycoming County, $2,800,000; Shawnee Branch, Juniata River, Bedford County, $1,200,000; Whiteley Creek, Greene County, $655,000; Tioga County site, $645,000, and Ricketts Glen, Luzerne County, $600,000.

Urges cities, industries to stop stream pollution

State Conservation Commissioner Henry Ward of Kentucky has asked cities and industries to begin now to stop stream pollution and help make a success of the Ohio River Valley Sanitation compact. (*ENR* May 6, vol. p. 676).

His statement accompanied invitations to attend the signing of the new interstate compact at Cincinnati, Ohio, on June 30. Mayors and other interested citizens of major cities along the Ohio and its tributaries will attend the ceremony.

The eight states that have indorsed the compact are Kentucky, Illinois, Indiana, Ohio, New York, Pennsylvania, Virginia, and West Virginia. Each will have three members on the new commission. The governors of the states are expected to attend.

POWERHOUSE SITE—Two 25,000-kw. units will be housed in a powerhouse at this site near Elizabethton, Tenn., to be served by the waters of Watauga Dam, now under construction by the Tennessee Valley Authority.

OBITUARY

Joseph A. Fahy, 65, chief of the construction division of the Veterans Administration, died June 1 in Washington, D. C. Mr. Fahy was graduated in 1903 from the University of Notre Dame in civil engineering. He taught at Columbia College, Portland, Ore., and afterward engaged in construction work with the Oregon Shortline Railroad and the Tennessee Coal and Iron Co. Before joining the construction projects section of the VA, Mr. Fahy taught engineering in the vocational occupation school of Catholic University, Washington, D. C. A captain in World War I, he saw service with the Corps of Engineers.

William G. Grove, 65, former engineer of bridges and structures in the Connecticut state highway department, died at Grand Rapids, Mich., May 27. He was a graduate of the University of Pennsylvania. His professional career covered connections with the American Bridge Co., Robinson & Steinman, the U. S. Army, and construction work in many areas of the western hemisphere. He retired from his Connecticut post last year.

Edward H. Loftin, 62, civil engineer, who was graduated from the U. S. Naval Academy in 1908 and was a consulting engineer in New York City, died May 26 in Boonton, N. J. He was stationed at the Navy Department from 1919 to 1924, when he resigned as lieutenant commander to become a consulting engineer.

Lionel G. McCray, 38, engineer with the Bureau of Reclamation in field charge of the location and construction of relocated railroads and highways around Culbertson Reservoir in southwestern Nebraska, died May 26. Mr. McCray had been with the bureau for 12 years.

Clifford F. Craig, 46, for 22 years a construction engineer for the Nebraska state highway department, died in Oakland, Calif., May 25. He had been doing irrigation and dam construction work in Arizona.

Edgar Stuart Miles, 66, president of Angus Robertson, Ltd. of Toronto, Ont., and Montreal, Que., died in Toronto, May 29. A civil engineer graduate of the University of New Brunswick, he became construction engineer for the building of the Welland Canal and for the intake and clear water tunnel on Toronto's lakefront. Earlier he had been with the Dominion Department of Works and made surveys of the Georgian Bay Canal, and supervised the construction of the St. Andrews Dam on the Red River. His work is seen in the harbors of Montreal, Quebec and Halifax.

Thomas Miller Fendall, civil engineer and chairman of the Loudoun County, Va., welfare board, died June 1 at Leesburg, Va. An 1897 graduate of the Virginia Military Institute, Mr. Fendall was the first holder of the Jackson-Hope Medal, highest honor at V. M. I. for civil engineering. He traveled widely and in 1901 conducted surveys in Nicaragua for the United States government. Before joining the county board, Mr. Fendall was connected with the Colorado Fuel & Iron Co. and the Youngstown Sheet & Tube Co.

Col. William N. Leaf, 49, United States District Engineer at Rock Island, Ill., died there June 1. A 1923 graduate of the United States Military Academy, Colonel Leaf also held a degree in enginerring from Cornell University. He was awarded the Distinguished Service Medal, Legion of Merit and Bronze Star for distinguished service in the Pacific theater.

George L. Hickenlooper, 63, an engineer in the St. Louis, Mo., water division, Department of Public Utilities, died June 1 in St. Louis. A graduate of Columbia University, he was with the Missouri Pacific Railroad until 1930. He joined the water division as an engineer in 1940.

MAJOR MEETINGS

American Society for Engineering Education, 56th annual meeting, University of Texas, Austin, Tex., June 14-18.

National Association of County Officials, Annual conference, Hotel George Washington, Jacksonville, Fla., June 21-23.

American Society for Testing Materials, annual meeting, Hotel Book-Cadillac, Detroit, Mich., June 21-25.

American Road Builders Show, Soldier Field, Chicago, Ill., July 16-24.

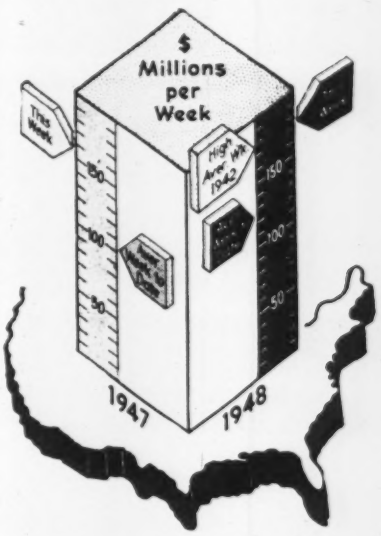
American Society of Civil Engineers, Annual convention, Hotel Olympic, Seattle, Wash., July 21-23.

Oregon Traffic Engineering Conference, Oregon State College, Corvallis, July 29-31.

Regional Surveying Teachers Conference, Green Engineering Camp, Ringwood, N. J., Aug. 26-28.

National Council of State Boards of Engineering Examiners, annual meeting, Hotel Utah, Salt Lake City, Utah, Aug. 27-28.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only
(Thousands of Dollars)

	Week of June 10 1948	Cumulative 1948 (24 wks.)	Cumulative 1947 (24 wks.)
Federal	$33,855	$509,259	$284,885
State & Mun.	64,962	1,076,881	719,545
Total Public.	98,817	$1,586,140	$1,004,430
Total Private	75,329	1,460,098	1,431,477
U. S. Total.	**$174,146**	**$3,046,238**	**$2,435,907**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1948 (24 wks.)	Cumulative 1947 (24 wks.)
Waterworks ...	$1,734	$95,223	$52,018
Sewerage	3,171	94,569	53,090
Bridges	6,385	122,917	75,061
Highways	35,872	449,874	337,340
Earthwork, Waterways ...	14,589	261,538	131,217
Buildings, Public	33,880	476,834	230,885
Industrial ...	14,490	471,134	355,167
Commercial .	55,599	879,795	858,792
Unclassified ...	10,426	265,464	342,337

NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (24 wks.)	Cumulative 1947 (24 wks.)
NON-FEDERAL ...	$2,062,100	$797,034
Corporate Securities	1,286,353	313,679
State and Municipal	775,747	483,355
**Total Capital ..... **	**$2,062,100**	**$797,034**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	June '48	455.80	219.16
Building Cost	June '48	339.26	183.39
Volume	May '48	258	113

EDITORIALS

VOLUME 140 NUMBER 24

June 10, 1948

Floods on the Columbia

REPORTS OF FLOODS on the lower Columbia River approaching record levels immediately raise question as to what provisions were made for flood control when Bonneville and Grand Coulee dams were built and why those dams were not effective in cutting the flood crest at Portland. The answer is that practically no flood storage could be provided at Bonneville and no significant amount in relation to the total flood flow of the Columbia is provided at Grand Coulee. The reason for this is found in the enormous flow of the Columbia River, its average annual total runoff being 146,000,000 acre-ft. Also, the peak flow is slow in development, so that headwater lakes and channels are all filled when it does come; and if the peak happens to coincide with a peak in the Snake River or in the Willamette, or both, high water at Portland and other towns and cities in the lower valley is inevitable. Substantial levees and channel clearing are the only sure protection there. Crests on the Willamette and Snake can be cut by storage reservoirs, some of which are being built, but they can only make minor reductions in flood crests on the lower Columbia when that stream is swollen by melting snow.

A Flood of Words Also

MELTING SNOWS in the Pacific Northwest loosed a gush of words as well as water. Emotionally inspired and thoughtlessly voiced, they render a distinct dis-service to the cause of real and effective flood control. Special anguish has been focused on the town of Vanport, a suburb of Portland, that was suddenly inundated, not because anyone had been particularly derelict in providing it with flood protection, but because its safety depended on an old railroad embankment that had not been built as a dike to protect human lives. The unfortunate citizens of Vanport were victims not of lack of flood control, but of the housing shortage that required them to live in a dangerously located wartime community. Nor does the inundation of Vanport point to the need for taking flood control in the Columbia River basin out of the hands of the Army Engineers, placing it in the hands of a Columbia River Authority. A new and untried agency could do nothing that the Army Engineers cannot do with the same dollars that it would have to persuade Congress to give it; and any change-over certainly would delay execution of the flood-control program that the Army Engineers now are carrying forward with such funds as Congress is willing to provide.

Simplifying House Construction

HOUSING PROBLEMS were tackled with great zeal at the Institute of Housing and Planning Studies held in New York City last week (p. 74). However, the broad scope of the meeting and time limitations did not permit thorough exploration of a building technique that offers real promise for producing low-cost houses of high quality. This method, involving a broad application of modular construction, calls for standardization and factory production of the parts of a house. Quite conceivably, house-building costs could be reduced thereby in much the same way as the cost of structural steel buildings was cut when rolled shapes were standardized. But while there is today some prefabrication of large-size wall panels and complete bathrooms and kitchens, much more could be done. The principle should be applied also to floors, roofs, windows, doors, and plumbing, heating and electrical systems. Sold through local dealers, like brick or lumber, in standard units and designed for rapid, easy on-site assembly, these modular products would go a long way toward reducing building costs. Of course, there are many barriers to be overcome—building-code hindrances, labor-union restrictions, and lending-institution conservatism. If, however, public acceptance can be secured on the basis of low cost for a high-quality product, these handicaps are not insuperable. Success of the undertaking hinges on leadership supplied by architects and engineers coupled with the active support of builders and manufacturers.

Home Sewage Disposal Systems

RULE-OF-THUMB PRACTICE has been the basis for design of individual home sewage-disposal systems for at least 70 years. To bring practice in line with established scientific facts, the U. S. Public Health Service has now launched a broad research program as outlined on page 102. The aim of this work is to uncover and correlate information lead-

ing to more effective and economical design of septic tanks and subsurface drainage systems. The importance of the program can be judged from the knowledge that in the United States more than 1,700,000 homes equipped with indoor plumbing facilities are located in unsewered communities. Prompt dissemination of the findings from this research will have an immediate dollars-and-cents value.

Reserve-Officer Opportunity

A STEP FORWARD by the Army to avoid what has been termed "a dangerous waste of the technical skills of scientific personnel in military service" is described on page 73 of this issue. Working in close harmony with a group of reserve officers, the logistics division of the Army general staff has developed a program whereby engineers and scientists can be organized in special groups for research and development work. Men attached to these groups, which will form part of the Organized Reserve Corps, are given assurance in an Army order setting up the program, that their skills will be usefully applied under both peace and wartime conditions. Designed particularly to invite the interest of demobilized officers who have failed to continue their reserve-officer affiliation because no program existed for technical specialists, the new policy also is designed to encourage scientifically qualified civilians to apply for reserve-officer status. The program seems to have been carefully conceived and one in which civil engineers may find a new opportunity to participate in planning for national defense.

A Job in Foreign Fields

SHOULD engineering-school graduates seek their first job-opportunity in foreign fields? Judging from the number of queries, this question commands more than usual interest this year. Since the answer is neither a simple yes or no, it seems proper to explore the situation.

In thinking about work in a foreign country, the young graduate must first distinguish carefully between the romantic and practical aspects of such a choice. He is at an age when it is easy to find enchantment in distant places, particularly if he has been exposed to the pictures and literature of travel agencies. Visiting a foreign country as a tourist is one thing; working in that same country is quite another matter. Adjustment to a climate, culture and many other conditions that differ markedly from that to which one is accustomed can prove to be a difficult emotional experience.

On the presumption that the young man is able and willing to divorce himself from persons, things and ways of living that have long been dear to him, let's take a look at his technical qualifications. In most cases, he lacks practical engineering and construction experience. Nowhere can this deficiency be more painful than in a remote corner of the globe; here success or failure of an operation often depends on ability to meet situations alone, as you find them, and through improvisation. Meeting such challenges calls for resourcefulness, and the latter quality is seldom acquired outside the school of experience.

Stripped of romantic delusions, but securely wrapped in the conviction that he can cope with varied situations, the aspirant for a foreign assignment must next undertake the task of proving his fitness to a prospective employer. Employers, it seems, are pretty hard to convince. A man hired for foreign service calls for a substantial investment in money to get him to the job as well as faith that he will be qualified to hold the job. Therefore, a happy outcome to the interview with an employer could be an offer to the candidate to accept employment in the home office for a year or so.

Here, indeed, is the ideal situation. The graduate engineer has the opportunity to gain experience in the practice of his profession, become familiar with the policies and stature of the company he is to represent, and to weigh all of these things in preparation for possible future activity as a foreign field representative. At the same time, his employer can appraise his potentialities and fitness for work away from home. And finally there will be time for development of a working knowledge of the language that is to be used.

Nothing that has been said is intended to disparage the interest of graduates in foreign work. But it is hoped that this brief exploration may be helpful orientation for what otherwise might prove to be a disillusioning experience.

ENGINEERING NEWS-RECORD
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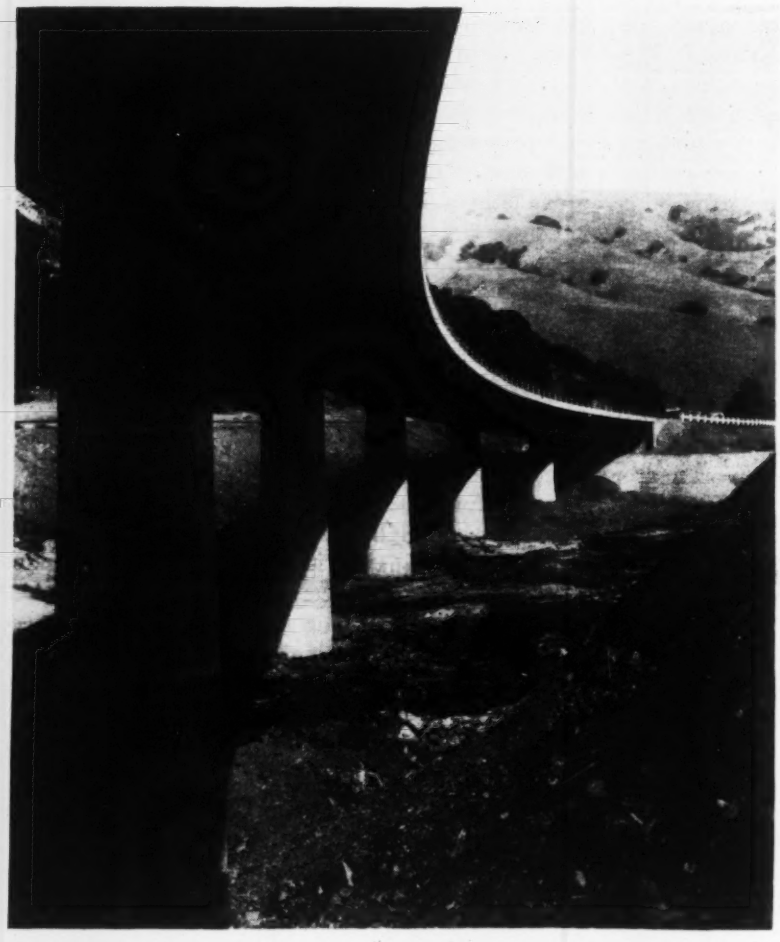


Box Girder on Single Columns Supports Curved Bridge Deck

E. R. Foley — Associate Bridge Engineer
G. D. Gilbert — Assistant Bridge Engineer
California Division of Highways
Sacramento, Calif.

A BRIDGE of attractive and unusual design was opened to traffic early this year in picturesque Niles Canyon, Calif., where Alameda Creek flows through a narrow winding pass in the low lying Livermore Hills on its way to San Francisco Bay. This pass, followed by State Highway 107, is important because it affords the only direct route for a water-level highway outlet from the San Joaquin Valley to the seacoast.

At the point where the new bridge stands—4 miles east of the town of Niles—the design problem was to eliminate five highway curves and a low wooden bridge and to do this without interfering with other uses of the narrow pass. At the narrow point the canyon walls crowd in so close that it was very difficult to avoid obstructing the necessary flood channel in providing for the transcontinental line of the Western Pacific Railroad, the aqueduct of the Spring Valley Water Co., a branch of the Southern Pacific Railroad and an important state highway.

The best solution of the problem was location of the highway in the critical zone on a bridge nearly 1,000 ft. long, cutting diagonally across the stream channel. It was necessary to put more than half the length of this bridge on a curve of 750-ft. radius which necessitated an 11 percent superelevation of the deck. The channel crossing, in which principal interest in the bridge centers, consists of six 81½-ft. spans, shown at the left. There are eight other spans ranging from 53 to 64 ft. in length in the western approach to the channel. It is under these shorter spans that the railroad passes.

Contract cost low

The contract for this structure as a whole, including about $150,000 spent on approaches, was $450,000. It should be said, however, that because of the amount of special carpenter work involved in making up the forms for circular piers, box girders and curved decks, it is probable that with the present rising costs if this work were to be done again a higher bid price on formwork might be expected.

The resulting structure, with its thin sections of reinforced concrete, gives a streamlined appearance pleasing to the eye. The circular piers, deep, narrow girders and the long overhang of the deck made for an unusual and attractive architectural effect.

The runoff of Alameda Creek reaches high peaks, extremely high velocities and carries drift up to 30 ft. in length. The skew angle of the crossing is nearly 60 deg. and this made it evident that to avoid either the piling up of driftwood at flood periods or costly skew framing of girders, some type of structure other than the orthodox pier and girder design would be required. With these controlling factors the best solution was found to be piers consisting of a single cylindrical column supporting a line of single-cell box girders surmounted by a 26-ft. roadway that cantilevers out on both sides of the box girders.

The six 81½-ft. spans in the channel crossing were designed as a continuous structure. In order to reduce temperature stresses in the columns and to facilitate framing of the girders on the 750-ft. radius curve, a hinge was placed in each span.

The box girders have a depth of

9 ft. and a width of 6 ft. The web walls are 12 in. thick at the center line of the span, increasing to 28 in. at the pier. The bottom slab is 10 in. thick at the center, increasing to 18 in. at the piers.

The 26-ft. roadway with curbs 2 ft. wide is supported on 13-ft. cantilevered slabs or arms of tapered sections. For architectural effect, continuity of the underside of these cantilever arms is broken at each pier by a false cap that was so constructed as to give the appearance of a supporting member or bracket.

The cylindrical pier shafts, varying in height from 35 to 55 ft., were given maximum rigidity by being cast monolithically with the girders at the top and anchored into footings at the bottom. This is in contrast with designs in which provision for some rotation is made or in which expansion details are provided at girder connections.

The cylindrical pier shafts have a diameter of 7 ft. at the top and a 1:48 batter. The shafts were made hollow to reduce the footing dead loads; the reinforced concrete walls are 18 in. thick at the top and thickness increases toward the base. The spread footings are 6 x 19 ft.

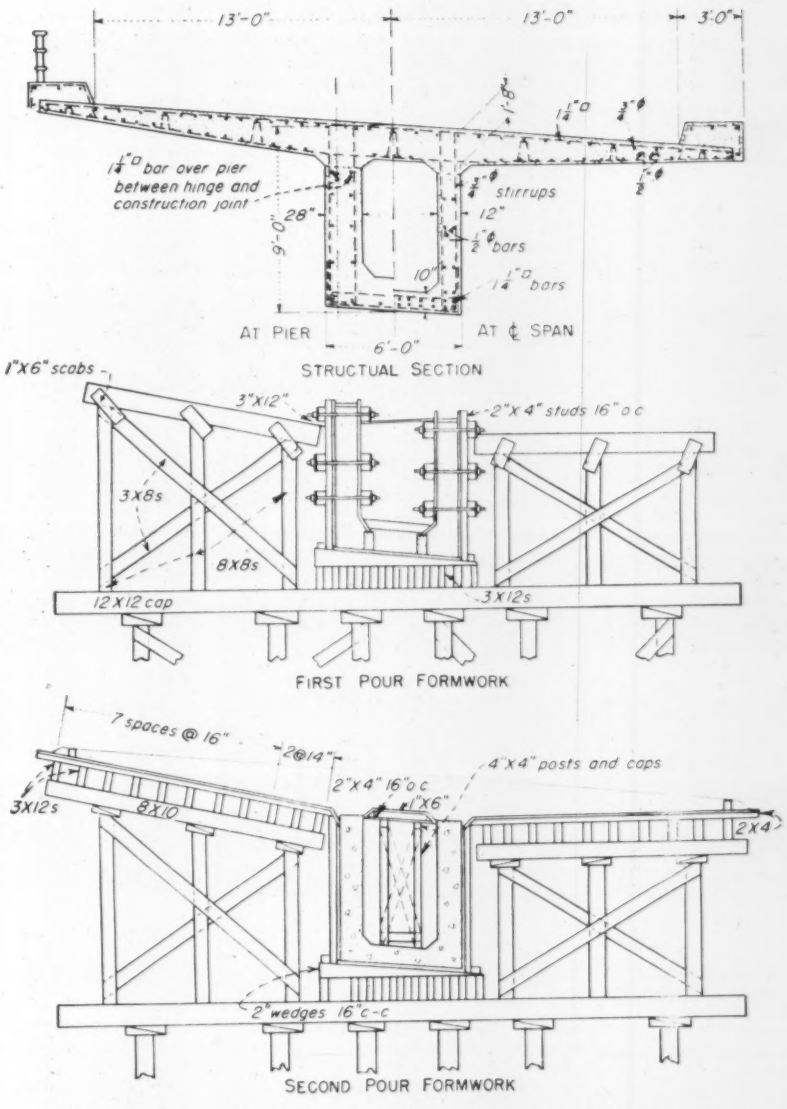
Formwork details

Forms for the circular piers were constructed the full length of the tallest pier for which the particular set of forms was to be used. The forms were then cut down to fit the piers on which they were subsequently used. Collars or diaphragms were used at 14-in. centers cut from two thicknesses of 2x12-in. planks; collar diameters were increased to correspond with the 1:48 batter. In assembling the forms, the collars were lined up on a working platform and 1-in. sheeting was used as the contact surface. Each piece of sheeting was marked in place and ripped to exact size to provide for the flare from a $4\frac{3}{4}$-in. width at the top to whatever bottom width was necessary to take care of the uniform increase in circumference due to the batter. This resulted in a many-sided figure with pleasing vertical lines.

After complete assembly, the "wind tunnel", as the tubular form was called on the job, was match-marked and cut transversely into three sections. As each pier was formed, the match-markings were used to assure getting the form in perfect vertical alignment.

A central hollow 4 ft. in diameter was formed in each pier uniformly, and was extended for the full height of the pier except in the top 18 in. which was cast solid.

The pier forms were stripped by opening a vertical joint to free the form from the concrete. Each collar was opened along this vertical joint in the planking and as the forms spread and loosened, a crane was used to lift them off the completed section of the pier. Uniformly good results were obtained in the exposed concrete surfaces even though some of the pier forms were used five times.



Typical sections through the box girders show how the cell was formed.

Although the deck follows a horizontal curve, the girders are straight between hinges where there are small angular breaks to enable the center line of the girders to follow the curve approximately. In the portion over the piers, the girder center-line coincides with the center-line of the roadway.

In addition to the five spans of the channel section, in which single-cell box girders are used, the five shorter spans also carry the deck on box girders. However, in these spans it was desirable to decrease the depth and increase the width of the girders. Consequently, in place of the single-cell design used in the channel, the shorter spans have two- and then

Numerous curves in the old highway are eliminated, a dangerous railway overpass cut out and ample provision made for the stream floodway

three-cell girders, supported on multi-column bents.

In this box girder construction there was considerable formwork. The triple-cell section was formed and poured in three steps. The bottom slab of the box and the 45-deg. fillets in the interior girder wall corners were first formed and poured. The fillet forms were then stripped and the wall forms placed. These were cross braced between interior walls, and exterior wall forms were held with form clamps and outrigger bracing. The deck, constituted the third pour.

On the long spans, using a single-cell girder, the lower slab and walls of the girder were placed in one pour. When possible this was preferable to the two-pour plan as it eliminated a construction joint at the bottom of the girder walls and made for less formwork. After stripping the girder wall forms, interior forms were constructed (to be left within the hollow girder) and supports for the cantilevered deck slabs were set up preparatory for the second or deck-slab pour. Reinforcing bars in bents, columns and caps, as well as the main longitudinal girder steel, were $1\frac{1}{2}$-in. square bars. Some of these bars were 60 ft. long and weighed 450 lb. each. The roadway slab was poured a full span length at a time, that is from hinge to hinge, but for only half of the bridge width.

The project was designed and constructed under the supervision by F. W. Panhorst, assistant state highway engineer—bridges. The contractors, R. G. Clifford and Louis Biasotti & Son, bid on the job as a joint venture, with the Clifford organization constructing the bridge and Biasotti's firm doing the grading and paving.

Shortage of Highway Engineers Begins in College

"The well which supplies civil engineers dedicated to highway construction is running dry." This is the conclusion that the American Association of State Highway Officials has reached, based upon a survey of employment preferences by June 1948 civil engineering graduates in 120 engineering colleges. The survey is reported by J. A. Anderson, Virginia Commissioner of Highways, in the April issue of *American Highways*, the AASHO publication.

Of a full-time enrollment of 179,273 engineering students (all branches) in the 120 colleges, 3,358 civil engineers expect to graduate this month. Five hundred eighty-nine of these civil engineers indicated a preference for highway work. In 33 schools, no June graduates indicated highway preference. This figure, 589, does not compare favorably with a 10,000-man professional and sub-professional shortage estimated recently by the Highway Research Board.

Comments returned with the survey questionnaires pointed to reductions below 589 in the number of men actually available. It was felt that many men would be faced with a choice between their preference, highway work, and other work which would yield $25 to $50 a month more.

Low salaries were considered the most important deterrent to entry into highway engineering, but other factors were mentioned, including pessimism about advancement opportunities.

Plan of Action

The AASHO report suggests a five point "Plan of Action."

1. Set up a scale of salaries that will compare favorably with that of industry. Recent state increases in most cases have not been enough.
2. Provide greater opportunities for superior men to advance rapidly in responsibility.
3. Sell highway engineering to engineering students by going to the schools and telling the highway department's whole story: salary scales, up-grading, types of work and general policies.
4. Create more highway scholarships.
5. Publicize highway engineering as a career.

The report also notes that of those who do enter highway departments and Public Roads Administration service, many soon depart for what appear to be greener pastures. The Minnesota Highway Department reports that from 1925 to 1940 a total of 319 graduate engineers were hired. By the end of 1947 only 20 percent remained. During the period between 1930 and 1941, 140 Purdue graduates joined the staff of the Indiana Highway Department. By the end of 1947 only 17 percent still were there.

Furthermore, the rate of retirement is increasing. During the last three years the AASHO has been conferring awards on highway department employees who have served 25 years. So far 932 awards have been made, and another large class will qualify this year.

Caisson (standing within shelter of drydock in foreground) for repairing concrete in spillway bucket, as well as barge in background and other floating equipment, will maintain shore contact by radio.

Radio to Aid in Use of Caisson On Grand Coulee Dam Repair

F. A. Banks
Manager, Columbia River District,
U. S. Bureau of Reclamation.

RADIO EQUIPMENT will be used to aid operation of the caisson being readied for service at Grand Coulee Dam in repairing concrete in the spillway bucket. For this special purpose frequency modulated (FM) equipment was selected because it would not be subject to interference from nearby 230,000-volt power lines. Radio sets will be used on the caisson itself, on attending barges and tugs as well as on shore. Thus radio is expected to closely coordinate the several pieces of equipment in moving the caisson on the Columbia River, in maneuvering it along the spillway, and holding it firmly in place while the working chamber is being lowered to the abraded areas.

Most of the erosion to be repaired was caused during construction of the dam when switching of the stream caused boulders and gravel to be carried into the bucket. Subsequently much of the foreign material was removed from the eroded areas and periodic examination by divers has shown that the rate of erosion has subsided materially. While the situation in no wise endangers the stability of the dam, the bureau believes that the eroded areas should be restored as a matter of proper maintenance.

The erosion was reported in *ENR* July 13, 1944, vol. p. 41. The very unusual design of the floating caisson as well as the drydock in which it is kept when not in use, both of which are shown in the accompanying illustration, were described in *ENR* July 19, 1945 vol. p. 72.

The floating steel caisson has considerable bulk; in plan it is 57x115 ft. and the height from the bottom of the side girders to the top of the access shafts is 97 ft. Winches will be located at strategic points along the banks, on the drydock and on the powerhouses at either end of the dam to move and to hold the caisson in desired positions. Even at low water the effect of currents must be carefully considered and it was believed that radio communication would be the best means of coordinating the effort to control and stabilize all movement.

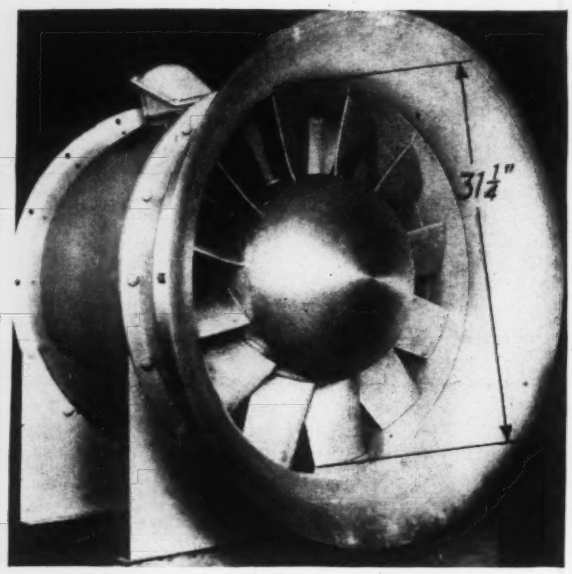
The proximity of very high-frequency power lines made the use of amplitude-modulated radio equipment practically impossible because of interference. This, plus the fact that all communication points are essentially within the line of sight, dictated the use of frequency modulated equipment which would not be affected by the power lines. Accordingly, FM sets operating in the 30- to 40-megacycle band were adopted. The system was assigned the call letters KNDE.

On floating equipment where steam power is needed for other services the FM sets are driven by a 90- to 250-lb. steam-driven turbogenerator supplying the 6-volt storage batteries from which the sets are operated. The equipment is installed in heavy compartmented boxes for protection against the relatively rough treatment expected in floating equipment. Loud speakers, microphones, control heads, antennas, etc., are installed at any convenient location within about 15 ft. of the transmitting and receiving equipment. The tugs use 6-volt generators with V-belt drive from the engines, supplemented by a 115-volt a.c. battery charger source which can be plugged into a power circuit when the tugs are tied up at a wharf with the engines shut down. The shore station is operated from the regular 115-volt a.c. power line.

Efficiency increased

Since radio sets have been put on floating equipment at Coulee Dam there has been a great saving of time and increased efficiency by eliminating whistle or hand signal methods and in some cases even the necessity for using messengers in row boats for transmitting detailed instructions. Other advantages are elimination of lost time while equipment is waiting for orders and the speed in handling emergency calls when accidents occur.

The system was laid out and installed by technicians of the U. S. Bureau of Reclamation. The radio sets are standard equipment manufactured by the General Electric Co.; mobile equipment was used on caisson, work barges and tugs while somewhat heavier equipment was more suitable for the shore station.



Fans developed for ship ventilation are mounted in the air ducts of an Ohio factory to conserve space.

Saving Space in Factory Ventilation

COMPACTNESS of layout was one of the primary considerations in designing the heating and ventilating system of a new $750,000 factory for Reliance Electric & Engineering Co. in Ashtabula, Ohio. Space-saving characteristics of this departure from conventional ventilating systems lies in the use of special fans, complete with motor, mounted inside the forced-air duct. These fans were originally developed for use in ships.

The new plant is a 480x250-ft. single-story steel-frame building containing 120,000 sq. ft. of area for the manufacture of 1- to 20-hp. a.c. and d.c. electric motors. Exterior walls are concrete block with brick veneer. Interior partitioning is concrete block, with cafeteria and other utility rooms faced with ceramic glazed tile. Flooring is 2-in. creosoted wood-block on a 5-in. slab.

Four lines of steel columns running the length of the building divide it into five 50-ft. aisles, the center one being covered with a fixed-sash, flat-topped monitor. Columns are spaced 40 ft. apart in each line. The roof is steel deck, with 1-in. insulation, supported on a system of trusses between columns.

This functional arrangement, with the lighting system and all but the downcomer ducts of the heating and ventilating system located above the bottom chord of the roof trusses, gives a maximum of unobstructed floor space in the manufacturing area. This layout was also highly desirable for the conveyorized straight-line production throughout the plant.

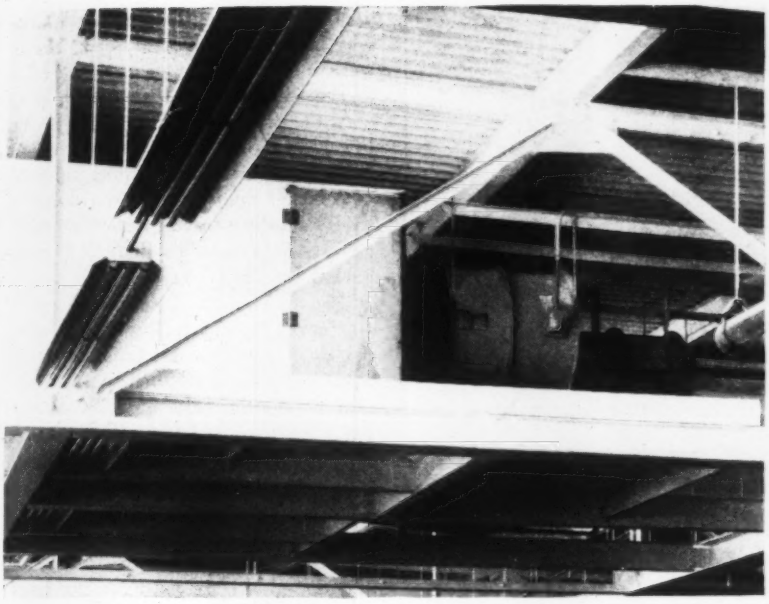
Ten independent duct systems

The ventilating system consists of ten independently controlled duct systems with air discharged at each building column through outlets located 8 ft. above floor level, giving uniform air distribution throughout the building. Twenty 31¼-in. dia. fans, each driven by a single-speed 3-hp. motor, move 18,000,000 cu. ft. of air per hour through the building, a sufficient volume to keep the plant interior under a slight positive pressure at all times, thereby minimizing dirt infiltration.

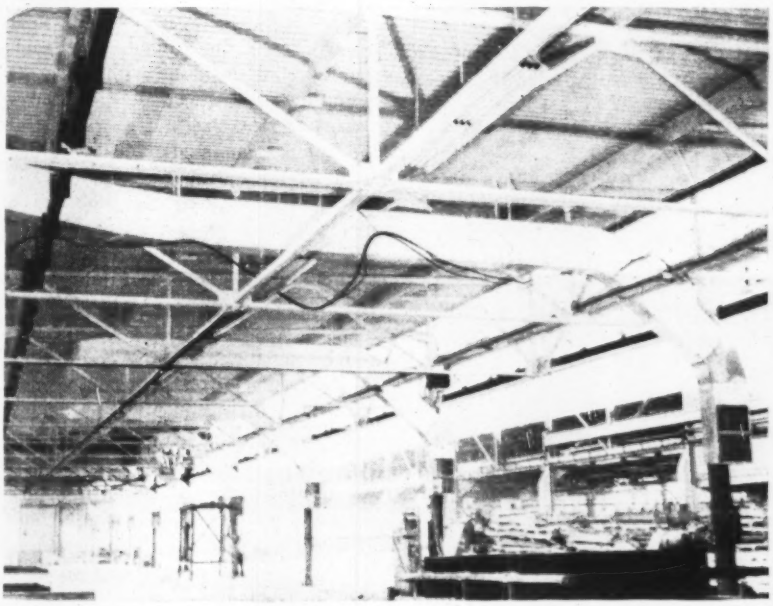
This system provides six complete changes of filtered air per hour during summer operation, and three complete changes per hour of tempered air during the winter. Natural exhaust is effected through eight 66-in. gravity-type roof ventilators equipped with pneumatically controlled louver dampers. The entire system operates against a water-gage pressure of 1½ in.

In addition to simplicity of duct arrangement, flexibility of control to maintain service on an uninterrupted basis was deemed of utmost importance. Both conditions have been realized in the system adopted of ten independently controlled sections. Interruption in the operation of one section does not interfere with the functioning of the others in carrying the heating and ventilating load of the plant. The use of several self-contained duct systems instead of a single large one has kept the size of the ductwork down, eliminating elaborate and cumbersome feeder installations to get the desired volume of air to all parts of the plant.

The separate systems heat areas 125x80 ft. through six discharge points. Downcomers closest to the wall distribute air to areas roughly 40x25 ft., while those on interior building columns supply areas 40x50 ft. Outlets on opposite walls of the plant are faced in opposite directions to maintain a continually circulating



Ventilation of the plant is accomplished with ten individual duct systems, each equipped with special built-in fans and motors. Outlets are on the columns.



Air ducts, ventilating equipment and lighting fixtures are located above the bottom chord of roof trusses to give an unobstructed working area below.

movement of air within the general manufacturing area.

Each duct system has its own air inlet, equipped with weather-resistant louvers and located in the sash just below the roof line. Air from each is fed into a plenum chamber supplied with filters of the washable viscous type, which are easily removed for cleaning and recoating. As the air is filtered, it enters a second plenum chamber where ample space has been provided for the placement of cooling coils should summer air conditioning subsequently be wanted in any part of the plant.

Air can be drawn from the second plenum chamber into either of two fans. One operates the year around, while the other is used only during the summer. For winter heating, the air is carried over steam coils, each of 451,000 Btu. capacity, converging into a single duct from which branch the downcomers. Dampers located in the duct network balance the flow of air at each downcomer.

Plenum chambers, steam coils and fans are all mounted on a platform above the bottom chords of roof trusses to make them easily accessible for inspection.

Design of the special fans mounted inside the ducts stems originally from research work in mine and tunnel ventilation conducted by T. H. Troller, vice-president in charge of engineering, Joy Manufacturing Co., Pittsburgh, Pa. Their space-conserving and weight-saving characteristics, together with their operating efficiency and quietness, made them preferable to centrifugal type fans for ventilating the Ashtabula plant, according to the designers.

Engineers and contractors

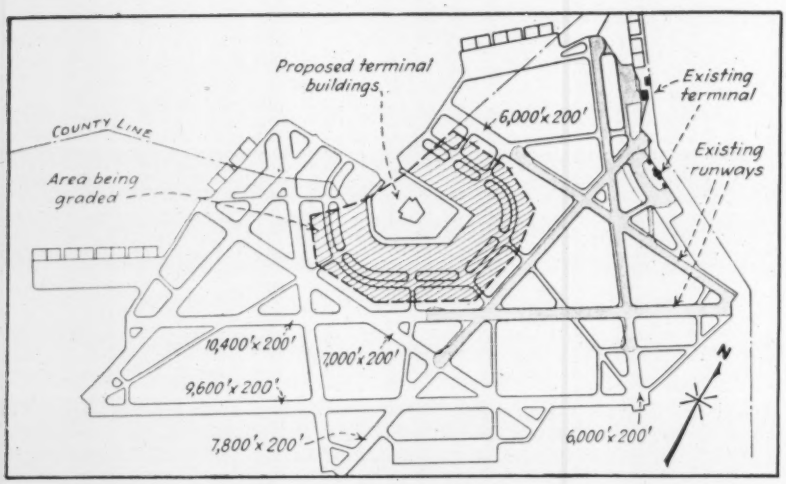
Gran Bros., Ashtabula, were the general contractors on the project. Arthur E. Rowe and Associates, Cleveland, Ohio, were consulting engineers. For Reliance Electric & Engineering Co., George B. McClellan was in direct charge of plant construction and R. C. Grow was in over-all charge of the entire project.

Stream Pollution Manual Available to Manufacturers

As part of a long-range program directed toward abatement of stream pollution, the Manufacturing Chemists' Associations has announced publication of a manual to guide plant managements in setting up company organizations to handle problems of industrial-waste disposal.

The manual recommends that waste disposal be made a part of research that develops new products. It is pointed out also that operation of pilot plants may provide valuable data on the waste produced by a new product as well as ways in which pollution control can be engineered into the design of a new plant before full-scale production begins.

Inquiries concerning the manual may be addressed to the association at 608 Woodward Bldg., Washington (5) D. C.



Existing runways at the Philadelphia airport will be extended, centering around the terminal area now being consolidated by an unusual use of heavy tractors.

Heavy Tractors Compact Swamp Fill For Airport Enlargement

C. C. Munoz
Office Engineer, Philadelphia Department of Public Works
Philadelphia, Pa.

CONSOLIDATION of a swamp area by surcharge fill compacted by vibration of heavy tractors is providing space for expansion of the Philadelphia Southwest Airport.

On the right bank of the Delaware River, seven miles southwest of the center of the city, the field now has four moderate-length runways and some terminal buildings, but extensive improvements are planned.

Since the terminal area must be relatively unyielding throughout, first work has been stabilization of about 160 acres that will be the site of the apron and the structure section of the expanded port. Originally swamp land, mostly covered by water during high tide, borings in this area showed a basal stratum of sand and gravel at a depth of 25 to 30 ft., above which were silt, clay and organic materials containing high percentages of water. Any concentrated load placed on this unstable material would be likely to form mud waves, which are difficult and costly to control.

The construction plan is to fill the terminal area 10 to 16 ft., to an elevation some 2 to 5 ft. above design grade, then await settlement and consolidation of the highly compressible sub-soil before removing the overload and building any structures. Excellent sand and gravel with only a small amount of fines is available near the airport and is being used for the fill. All slopes, in both cut and fill, are made very flat (from 10:1 to 40:1) to avoid the danger of mud waves caused by abrupt changes of load on the unstable subsoil. A minimum depth of 6 ft. of selected and compacted material below final grade at all paved areas is required.

The first step was to cover the swamp area with about 2 ft. of sand and gravel, to make it possible for loaded trucks to operate over the fill. A drainage ditch about 12 ft. deep was dug around the terminal area to facilitate flow of water from the consolidated fill, and to collect the surface drainage. Material above ground water in the ditch area was moved most economically by 12 cu. yd. carrying scrapers. Wet excavation was handled by cranes using 2 cu. yd. dragline buckets loading 10 cu. yd. end-dump trucks. Bank slopes were made 10:1.

The wet material was mostly silty clay but was suitable for use in the lower part of the fill where it could be covered with a minimum of 6 ft. of selected material. It was dumped by the hauling trucks and when sufficiently dry, was leveled and compacted by a heavy tractor.

Above the wet fill, sand and gravel was spread in 12 in. layers approximately parallel to the finished grade line. A plow and belt-type loader with a rated capacity of 1,000 cu. yd. per hour was used to load 13 cu. yd. bottom-dump trucks for haul from the borrow area 2 miles away. Carrying scrapers, pulled by two wheel rubber-tired tractors as well as trucks and loaded by 2 cu. yd. shovels, also were used for the hauling.

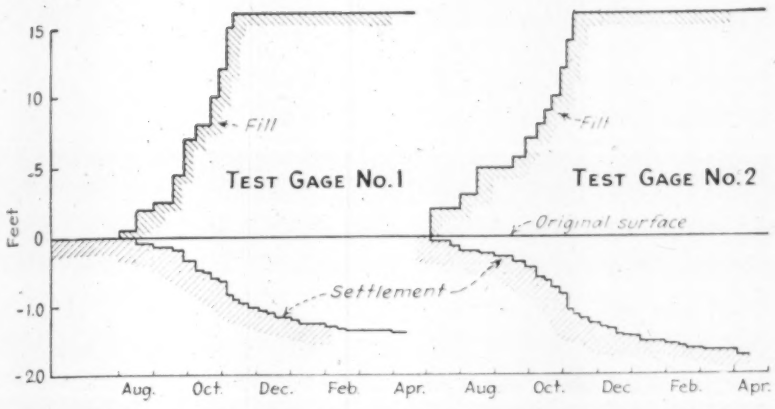
Heavy tractors required

The specifications for compaction required: "Each layer of the fill shall be separately compacted. The compaction shall be done with a tractor weighing at least 17 tons and having cleat and track transport, and the compaction shall consist of one track of the tractor passing over the entire area at least six times. The material shall contain natural moisture content at the time of compaction." Only the largest of the crawler tractors meet this weight requirement.

Although quite good compaction was obtained from the hauling and spreading operations, the six specified passes of the heavy tractor were required. No limiting speed was specified for the tractors, but they operated at about 2.7 mph. Bulldozers were used on the compacting tractors to add weight and to keep the fill leveled.

As an aid in inspection, each compaction was made with the tractor running at about right angles to the previous coverage. The tracks on the sand showed clearly where the tractor had run.

The heavy tractors were used for compaction—in preference to sheepsfoot or other rollers—because of the vibration caused by these machines. The value of this equipment was evident in the early stages of the filling. A loaded hauling truck weighing



Consolidation of underlying soft material was speeded by a surcharge fill.

about 34 tons gross would produce little or no vibration in the surrounding ground, while the vibratory effect of the tractor was very noticeable twenty or more feet away from the machine.

Laboratory tests of the sand and gravel used in the fill showed that at optimum moisture of 9 percent the density of the fill was 112.5 lb. per cu. ft.

Field tests of compaction were made about 2 ft. below the surface. These tests showed that 95 percent compaction (modified AASHO method) was obtained from the hauling and spreading operations, and that 110 to 115 percent was obtained by the six passes of the tractor, although the specifications did not require a specific percentage of compaction.

Settlement rate checked

Before the fill was started, test gauges consisting of heavy steel plates 3 ft. square with 5-ft. length of pipe welded at the center were placed on the original surface, and levels recorded. As the fill reached the top of the pipe an additional 5-ft. section was attached and levels were again recorded at intervals of a week to determine the rate of settlement.

The accompanying chart shows graphically the rate at which test gages Nos. 1 and 2 settled as the fill was built up.

The fill at these gages was completed in November, 1947 with a total height of 16 ft. of compacted material. Settlement during October and November was at a rate of about an inch per week, but by March 1948 it was down to about $\frac{1}{4}$ in. per week. Total settlement at the gages at the end of March was 1.38 ft. and 1.72 ft.

Substantial and satisfactory progress has been made in consolidating the original ground under the terminal area. Levels being taken on many test gages and hubs will indicate when the time has arrived to proceed with the subsequent steps in the development of this portion of the airport. Heavy structures will be supported on piles but the consolidated ground will be adequate for pavement and drainage structures.

When this grading work started, ground water was at the surface. As the fill was built up, the water table rose but was always several feet below the new surface. This has been an unusually severe winter, which may in part account for the fact that at the highest portion of the fill, the water table today is only 1 to 2 ft. below the surface.

This project is under the supervision of the Philadelphia Department of Public Works of which Thomas Buckley is director, A. Zane Hoffman is chief engineer, and S. S. Baxter is assistant chief engineer. Paul Kerth is resident engineer, representing Airways Engineering Consultants, Inc., of Washington, D. C., who are the consulting engineers for the project.

Public Works Performance Costs Reveal How Taxes are Spent

Reporting on its stewardship, the Montclair, N. J. Department of Public Works has issued a four-page illustrated folder showing unit costs of various services during 1947. Some of the items included are street cleaning; patching and sealing; leaf and snow removal; sewer maintenance; refuse collection and street lighting. Highlights from the report are:

Street Cleaning—To clean 154 miles of streets, 7,444 man-hours and 3,133 machine-hours are required annually. A total of 1,430 cu.yd. of debris was collected by hand at a unit cost of $3.58, and a 13-yr. old machine swept 3,955 miles at a cost of $2.67 per curb-mile.

Street Patching — To repair 80 miles of pavement, 174 tons of bituminous concrete, 2,430 gal. of asphalt and 149 tons of stone were used. Equivalent to a full-width pavement—three blocks long—3,740 sq. yd. of repairs were made at $2.05 per sq. yd.

Street Sealing—To prevent moisture deterioration, pavements on 39 streets (7.2 miles, 107,900 sq. yd.) were sealed with 35,740 gal. of tar and 1,280 tons of stone. This work was done for $0.094 per sq. yd. with a $2,989 state-aid allotment.

Leaf Removal—At a cost of $0.69 per cu. yd., 4,350 cu.yd. of leaves were picked up and hauled away.

Snow Removal—Nineteen miles of streets were sanded for each snowfall, 154 miles of streets were plowed and 1,000 cu.yd. of snow was removed from the business district for each inch of snowfall. Total snowfall for 1947 was 55 inches and the cost for removal was $24,752.

Sewer Maintenance—At a cost of $0.08 per foot, 79,900 lin. ft. of sanitary sewers were dragged and cleaned. From 395 storm-water inlets, 529 cu. yd. of debris were removed at a unit price of $4.84.

Refuse Collection—Picked up at the rear door of 11,000 family units and hauled to the dump twice weekly, refuse was removed for $0.14 per family unit per collection.

Street Lighting—Illumination for 91 miles of street with 2,256 electric lamps cost $0.033 per lamp per night.

Engineers' Part in Foreign Trade

Farley Gannett
President, Gannett, Fleming, Corddry and Carpenter, Inc.
Harrisburg, Pa.

Editor's Note—The author, Farley Gannett, speaks with authority based on long experience as head of an organization that has done much work in Central and South American countries. The firm that he heads not only has provided engineering services for such countries, but has built and operated plants to supply public services.

THE UNITED STATES is now the greatest creditor nation of the very few such nations in the world. It used to be one of the largest borrowers. It was due to our borrowing from Europe, largely from England, that we became a great industrial nation. Most European countries used to be creditor nations, now exceedingly few of them are. Before World War I and all through the 19th Century, Great Britain was the great creditor nation.

International firms developed

During this period in England's history, British engineers played an important part: several great international engineering firms were created and their work extended over North and South America, Africa, India, Egypt and China. Some of the heads of these firms were knighted in recognition of their accomplishments.

The opportunity now exists in the United States for the development of great international engineering firms; in fact some are tending in that direction. There are several large contracting and financial organizations that have been and are devoting much of their attention to foreign work. Some of these have engineering departments, while others are associated with designing engineering firms.

When I was a very young man in the early years of this century, I travelled from Boston to El Paso, Texas, with an Englishman of about my own age. He had come to the United States to learn something about the U. S. railroads. His father had advised this as he was apparently a considerable investor in the securities of these railroads. Twenty years later, when I was in the Argentine I made friends with several Englishmen who were officials of English owned railroads in that country, in which they had lived many years. Later in Brazil, I rode from Santos to San Paulo over an English owned and operated railroad, which carried most of the products from the San Paulo area to the coast.

These three experiences were firsthand proof to me of the wide financial interest British capital had in railroads in the western hemisphere, and this was not by any means limited to railroad securities. For generations England loaned or invested its excess money all over the world and the returns came flowing back in the form of interest, dividends or profits in other form.

Thousands of British citizens live overseas managing these investments. British industry received business from those countries in which British money was invested, thus helping to keep its home plants running at far greater capacity than England's population alone demanded.

Through these investments in foreign properties British citizens created and owned the source of a great demand for England's manufactured products, and they controlled the purchase by the managers of these properties through such ownership.

Money seeking investment

Today the United States has a greater credit capacity than any European nation ever had. Even though our national debt has absorbed a vast amount of this country's savings there still remains a stored up surplus that is urgently looking for investment. This occurred after World War I on a far smaller scale and we loaned money overseas in large amount, but many of the loans went sour. Much of it was sent overseas as loans and little watch was kept over this money after the loans were placed. We do not want to be caught that way again.

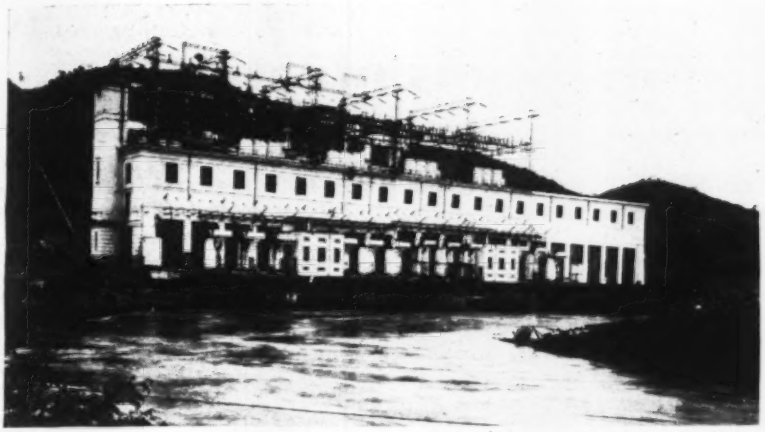
However, we did some constructive investment in those days, notably in telephone and telegraph and in electric utilities in Europe and Central and South America, China, and elsewhere. Some of our great corporations such as Ford and General Motors built and operated extensive foreign branch manufacturing and assembling plants.

We must build abroad

That is what I believe we must do now, only on a vastly larger scale. We must do as creditor nations have done before: build plants in foreign countries with our money and own and operate them, to be repaid, if they are successful, out of their own earnings and not out of national credit balances or national loans.

It was certainly largely the money that citizens of creditor nations invested in the United States for nearly a century that made us the nation with the greatest buying power in the world: a nation on which Europe depended through two great wars. In the same way we can help develop other countries and increase the buying power of their people.

But we must take measures to insure investors in such projects that they will be protected. This is, of course, dependent on the settlement of the threat that pervades much of the world today of unstable governmental and economic conditions. In



Hydro plants such as this Parahyba development of the Brazilian Hydro Electric Co., a Canadian corporation, are examples of the type of foreign work needing American capital and engineering know-how.

many countries today any investment of our funds would be a bad risk, but there are others where it probably would be a safe one.

Engineering studies needed

If we invest our money in foreign lands it should be only after thorough local study of each individual project and of each country. The return should be large to provide against the unknown or unexpected risk factors. To protect ourselves in so far as possible against loss and insure as far as possible a commensurate profit, industry in the United States should familiarize itself with the general and detail situation abroad. Of course we have always done this to a certain extent but now that our need for foreign investment has become so vastly greater than ever before, representatives of U. S. business in ever increasing number should go and are going all over the world. Eventually, just as the English did, there may be United States settlements in many countries founded by the managers and employees of plants owned or partially owned in the United States.

Naturally, among those to study foreign situations will be many engineers. The investigators will be representatives of engineering and contracting firms or of the builders of works and plants. Or they might be representatives of combinations of engineering and contracting firms that would take a project from its inception and hand over a finished plant to its owners in the U. S.

Inquiries are coming into our State and Commerce departments and to our engineering and contracting firms for engineers to investigate irrigation, water power, roads, harbors, docks, railroads, and all kinds of other works, textile mills, etc.

Affiliations with foreign firms

The tendency in many Central and South American countries is inclined toward combinations of U. S. engineers, contractors and manufacturers with nationals of such countries to do work of this sort, the nationals putting in some of the money and owning a part interest. If the engineering and construction work result in plant construction in which U. S. money wishes to invest, then the natural thing would be for U. S. citizens to manage and operate them; and they in turn would buy raw materials, machinery, and parts from the United States markets.

This is the way, it seems to me, that we are to get a real expansion in our exports; and it will not require that the countries in which the work is done have the money to pay for it. The jobs themselves being built and owned by U. S. capital, will, if successful, pay for themselves.

Probably today the U. S. oil companies are the largest investors in foreign countries. Their work in developing the oil fields of South America and the Near East has involved hundreds of millions of dollars, and more work is in progress and prospect. Many U. S. engineers, not only oil experts but others, have been sent abroad on this oil development work. Many have stayed to build and maintain not only the necessary pipe lines and refineries, but to design and construct towns to house employees and to operate the works and protect the investment.

U. S. foreign trade

If we can build our export trade up in this way to say 15 percent of our total business, it would amount to about 30 billion dollars and fill much of the gap between full production from U. S. industry and future home consumption of its products.

Before World War II we exported about 5 percent of our national production, with relatively balancing imports. This seemed to be a normal and quite steady foreign trade. At that time our national income was about $80 billions a year. Now it is running nearer $200 billions; hence, at this same percentage, our export sales would be $9.5 billion. As a matter of fact, 1947 exports it is estimated were $15 billions, due to extraordinary demands for foreign relief, rehabilitation and maintenance of our overseas forces.

On the other hand, present estimates indicate imports in 1947 of only $6 billions. Much of this gap between exports and imports may, if world conditions permit, eventually be filled by investments of U. S. owned dollars in foreign undertakings, built and managed by the owners of those dollars, often in partnership with native citizens. For the building and equipping of these operations, many U. S. products will naturally be purchased. Also, the wage scale may be raised in localities where such plants are built. The wants of this labor and its ability to buy, will be directed toward U. S. products, thus again increasing our exports.

The North American engineer is a vital cog in this great wheel of foreign investment of U. S. funds, and he should be looking east, west and south for his future. We may not always have work for 60 million in this country, hence to protect his future and at the same time help U. S. business to help the world, the engineer should prepare himself and interest himself in living and working in foreign countries.

Notes On Waterworks Meeting

When the American Waterworks Association met in Atlantic City, N. J. on May 3-7, more than 100 papers and discussions were presented on supply treatment, operation and maintenance of waterworks utilities.

Abstracts from papers of wide general interest are assembled in this report. These include discussions on groundwater development, air-conditioning demands, fire-protection requirements, up-flow clarification tanks, waterworks school programs, cone valve operation; and cathodic protection for steel tanks. Information on availability of the complete papers may be obtained from the American Water Works Association, 500 Fifth Ave., New York 18, N. Y.

A news story on the conference appeared in *ENR*, May 13, vol. p. 685, and a discussion of the use of sulphur compounds for water-main joints was published in the issue of May 20, vol. p. 742.

GROUNDWATER DEVELOPMENT AND USE

Demands for underground water for industrial, municipal, agricultural and domestic purposes are mounting far out of proportion to the increase in population. The increased demand can be attributed to improvements in well construction, deep-well pumping equipment, efficiency of pumps and motors and lower power rates. The rapid growth in the use of air-conditioning is increasing the draft on wells and overloading drainage systems.

This situation is encouraging passage of laws requiring conservation of measures for use of groundwater by recirculation through cooling devices or return to the ground through recharge wells. Some states that have recently passed laws regulating groundwater use are concerned about constitutionality because of the effect on the common-law doctrine of proprietary rights. The courts, however, are modifying their rulings to fit increased knowledge and applying the policy of equitable apportionment. —*H. T. Critchlow, chief engineer, division of water policy and supply, Department of Conservation, Trenton, N. J.*

Groundwater development should be preceded by study and investigation including prospecting and geophysical testing in the field. From investigations the location, extent and general nature of aquifers can be determined as well as whether or not test holes should be sunk.

Drilled test holes should always be sunk before completion of plans for well construction and selection of pumping equipment. Testing will insure successful completion of a well development to a considerable extent.

A carefully planned testing program will provide:

1. A sufficient number of holes to determine area, thickness and depth of each aquifer.
2. Prospect holes, 2 in. in dia.; test holes, 4 in. in dia.
3. Representative samples of natural formations.
4. Samples plainly marked as to depth and location.
5. Successive measurements of the water table during test drilling.
6. Water samples obtained from each aquifer.
7. Analysis of formation and water samples by experienced engineers who are qualified to interpret hydrologic and geologic data.

All test data should be checked, correlated, studied and assembled in a written report that includes a groundwater map.

After completion of preliminary investigations, the type of well best suited to the conditions can be determined. While only four methods are employed to construct walls—driving, digging, hydraulic and drilling—well-development and gravel-treatment procedures have been greatly improved in recent years. Use of this knowledge permits selection of wells that will develop maximum yield and justifies development of aquifers previously considered of little value.

In the past little attention was given to well design. Fundamental relations—such as well diameter and depth to yield, screen length and percentage of screen opening to yield, or drawdown to yield—were not known. These relationships as well as methods for determining groundwater velocities and yields of water-bearing formations can now be evaluated. Application of such engineering data provides insurance that well developments will be successful.

Selection of the proper type of well may be guided by the following principles:

1. A well should be built of material to give the longest life under the revealed soil, water and pumping or operating developed conditions.
2. A well should yield a maximum quantity of water with minimum drawdown.
3. A well should be built so that only usable water can enter at any point.—*E. W. Bennison, office engineer, Edward E. Johnson, Inc., St. Paul, Minn.*

Loss of water from the Prado Flood Control Reservoir (Santa Ana Valley Irrigation Co.) in southern California, by seepage under and around the impounding dam, has been minimized by making gravel foundation impermeable. This was accomplished by application of the Shellperm process—a method for injection of asphalt emulsion into porous strata to shut off underground water flow.

The process involves injection of fine-grained emulsion of low viscosity (approaching that of water) into sand, using a chemical means of controlled coagulation in the absence of air. Rate of coagulation is part of the science of application. If too rapid, insufficient emulsion will be injected before pumping resistance becomes too great. If too slow, emulsion may be displaced by underground flow.

The emulsion plasticizes and adds cohesion to substrata. It is not em-

ployed as a mechanical solidifier as in pavement work, but only as a hydraulic barrier.

Emulsion is injected into substrata under pressure through a driven pipe with a special point. When the base of the formation is reached, the pipe is retracted slightly to open the point. As injection proceeds, the pipe is pulled up in stages. A given amount of emulsion is injected per foot of withdrawal, the amount being determined by voids in the soil and the diameter of the column to be formed.

The hydraulic barrier consists of a series of abutting columns. Injection of alternating columns has been found advantageous. The first line of columns aids distribution control of emulsion in the second line and serves as an exploratory survey that provides the basis for computation of an accurate cost estimate.

Normally, 2⅜ in. o.d. pipes are driven to depths up to 32 ft. in 15 to 20 min. The injection rate averages about 200 gph. under a pressure of 20 to 30 psi. at the head of the pipe. At times a maximum rate of 300 gph. has been attained.—*Loren E. Blakely, consulting engineer, Orange, Calif. and Victor A. Endersby, civil engineer, Shell Development Co., Emeryville, Calif.*

AIR-CONDITIONING USE

A recent survey of the manufacturers of air-conditioning and refrigeration equipment indicates: (1) more than 90 percent of the water-cooled installations are supplied from city mains; (2) average consumption of water ranges from 1.5 to 3.0 gpm. per ton of refrigeration; and (3) at least 90 percent of the air-conditioning equipment sold in 1947 does not conserve water.

Several cities restrict air-conditioning water use. Chambersburg, Pa. prohibits installation of equipment of five tons or more without an economizer or cooling tower. New York City limits wastage to the annual equivalent of a continuous flow of five gpm. Miami Beach, Fla., does not permit connection of air-conditioning units to sanitary sewers if waste exceeds two gpm.—*Ted H. Kain, general manager, The Columbia Water Co., Columbia, Pa.*

Results of 50 questionnaires sent out to determine how air-conditioning demands affect water-plant operation and what regulatory steps are being taken, reveal that only a few managers have given the problems any study. The most common method of regulation was found to be a restriction of discharge into the sewer to a small amount. Discharge of water from air-conditioning systems into sewers is prohibited by Pasadena, Calif.

In contrast, Phoenix, Ariz., with more installations than any other city in the United States, encourages use of water for air conditioning. Phoenix officials believe that water-use restrictions are not justified because the sale of water is a business. This policy is supported by statistics showing increasing consumption with adequate revenues for the past 17 years.

A law to restrict use of groundwater for air conditioning was passed by the Indiana General Assembly at its last session. If more than 200 gpm. are used, the water must be recirculated or returned to the ground unless a permit is obtained.—*Frank C. Amsbary, Jr., manager, Illinois Water Service Co., Champaign, Ill.*

Engineering data used ten years ago to select air-conditioning equipment cannot be applied today. As power costs have decreased, water and equipment costs have increased. Favorable utility rates have encouraged operation of refrigeration systems at higher condensing temperatures that require more electricity and less water per ton of refrigeration. This trend should be supplemented by greater use of conservation equipment, particularly where water shortages are impending or acute.—*Lynn B. Mighell, Carrier Corp. Philadelphia, Pa.*

A recent survey of 56 large cities shows that 23 percent of the water supplies should be considered critical on the basis that summer demand for six months averages 90 percent or more of rated waterworks capacity. Study of methods for limiting high usage should be undertaken in eighteen cities where consumption exceeds 70 percent of capacity. Only 45 percent of the systems have supplies adequate for the next few years but 20 percent have sufficient capacity to warrant encouragement of water use.

Based on this survey, the waterworks in the United States may be classified under four headings: those with inadequate supply, those which should be studying additional development, those which enjoy safe balances of supply and demand, and those which can encourage sales for increased revenue.—*Elwood L. Bean, principal assistant engineer, Bureau of Water, Philadelphia, Pa.*

FIRE-PROTECTION NEEDS

To determine fire-flow requirements in residential areas with greater uniformity, the following method is recommended:

Fire flow in areas with individual buildings should be served by hydrants capable of delivering two 500-gpm. streams. For a small area with low to moderate building heights (eight-room, two-story houses), one hydrant should be sufficient if buildings are separated by 30 ft. on all sides.

Where two buildings may be involved in a single fire (One side exposed), two hydrants less than 500 ft. apart and each capable of delivering 500 gpm. are needed.

When buildings are exposed on two sides, the total available fire flow should be 1,500 gpm.

When houses are attached or the danger of a fire involving several buildings exists, a fire flow of 2,500 gpm may be necessary.

For 2½ to 3-story dwellings of more than eight rooms or multiple occupancy, fire-flow quantities should be 50 to 100 percent greater (no exposure—1,000 gpm.; one-side exposure—1,500 gpm.; two-side exposure 2,500 gpm. and severe exposure—5,000 gpm.)

Individual unexposed buildings (hotels, dormitories or apartment houses) require flows of 1,500 gpm. for one or two stories to 3,000 gpm. for over four stories.

Densely built up sections of three-story or higher buildings may require up to 6,000 gpm.—*A. C. Hutson, assistant chief engineer, National Board of Fire Underwriters, New York, N. Y.*

Mechanically conditioned "water fog" and chemically conditioned "wet water" promise to widen the effectiveness of water as for fire-extinguishing agent.

Discharge of water as fine spray

from high-pressure nozzles (100 to 600 psi.) and specially designed heads improves extinguishment by extending surface area and promoting heat transfer and quicker cooling. Atomized water streams reduce the danger of current conveyance when used around electrical equipment. Safe distances are reduced from 1/10 to 1/20 of those for nominal hose streams. Reported data give: 24 in. for 33,000 v.; 32 in. for 50,000 v.; 64 in. for 110,000 v.; and 124 in. for 220,000 v.—*M. M. Braidech, director of research, National Board of Fire Underwriters, New York, N. Y.*

UP-FLOW TANKS

Short-period flocculation and clarifier basins will be incorporated in Miami, Fla., water-softening plant on the basis of pilot-plant tests and information obtained from existing installations.

Pilot-plant studies were run on three types of upflow tanks—Hydrotreator, Accelerator and Precipitator. With normal alum dosages, no unit produced better results than those obtained in the Miami softening plant (rapid mix, flocculation and clarification basins). However, performance of upflow units was greatly improved by increasing alum dosages 600 to 800 percent.

In addition, sodium-silicate dosages of $\frac{1}{4}$ to $\frac{1}{2}$ grain per gallon produced a satisfactory sludge blanket and maintained effluent turbidity consistently below 5 ppm.

As a result of the studies, storage for alum and sodium silicate as well as equipment for feeding either or both chemicals will be provided in the Miami plant. Inspection of several existing short-period, upflow tanks lead to the following conclusions:

1. Upflow tanks can produce as good or better quality effluent at the same or lower cost than that obtained in conventional settling basins.

2. Construction costs are less for the same degree of treatment by conventional methods.

3. Sludge concentrators and automatic blowoff equipment should have ample capacity. Equipment subject to outage, such as timing devices and solenoid valves, should be duplicated. Manual plus automatic control appears desirable.

4. Overflow rate in gal. per sq. ft. per min. is to a great degree a function of each water supply and the chemical treatment best suited to that supply. Therefore, the manufacturer's overflow rate should always be checked.

5. Uniform chemical dosage is very important. Automatically controlled feeders should be installed where flow varies throughout the day.

6. As trouble is likely to come faster and more frequently with upflow basins than with conventional settling tanks, well-trained and skillful personnel are required for successful operation.—*C. F. Wertz, resident engineer, Department of Water and Sewers, Miami, Fla.*

TRAINING PROGRAMS

The wide scope and variety of in-service training courses for waterworks operators was evidenced in reports from typical states. These included:

New Jersey—Starting in 1931 a two-week's short course was initiated at Rutgers University in collaboration with the New Jersey State Department of Health and two local waterworks associations. Experience has shown that a course conducted over a six-week period with instruction on Tuesdays and Thursdays is desirable. The program provides for 21 hours of instruction on distribution systems and about 50 hours on water treatment. A fee of $15 is charged. Average attendance is about 20 men a year.—*Harry N. Lendall, professor of municipal and sanitary engineering, Rutgers University, New Brunswick, N. J.*

Florida—Since 1930, when a training program was started, 1,380 men from 116 towns have attended. A two-day course of 40 hours of instruction and laboratory work is now given. In addition, correspondence and regional short courses are offered. The program is under the direction of a group known as the Florida Committee on Water Supply and Sewerage Education, including representatives from three universities, the state board of health, and the water and sewage works associations—*A. P. Black, professor of chemistry, University of Florida, Gainesville, Fla.*

Michigan—Three types of educational training, designed to help professional people keep abreast of new developments as well as to raise educational qualifications for technicians, are offered in Michigan. The first of these now provides five courses, each of one week's duration, with lectures and laboratory training.

Subject matter includes: chemistry and mathematics; chemical laboratory tests; bacteriological tests; hydraulics; and operation and maintenance of water and sewage plants. The second type of instruction is a home-study course for operators. The third opportunity is a "high-level" course consisting of a two or three-day meeting held every second year for the discussion of special technical problems.—*Raymond J. Faust, chief, bureau of engineering, Michigan State Department of Health, Lansing, Mich.*

New York—Schools for water-treatment operators have been conducted since 1931 to provide instruction in protection of sources of supply, operation of treatment works and laboratory control of filter plants. These courses are sponsored by the state department of health, Conference of Mayors, state department of education, Association of Towns and the local section of the AWWA. Although three-day schools have been used, the trend is to organize four-hour courses on Saturday mornings of each week for 30 weeks.—*Charles R. Cox, chief, water supply section, New York State Department of Health, Albany, N. Y.*

CONE VALVE OPERATION

Several valves have been devised that operate quite easily against unbalanced hydraulic pressure. One such device is the cone valve.

This valve consists of a plug pierced with a transverse hole. With the hole parallel to the pipe, water flows through the pipe. When the plug is turned 90 degrees, flow is stopped.

Size for size the cone valve costs much more than a gate valve. Much of the extra cost is due to the plug-rotating mechanism.

Cost can be reduced by using a smaller size valve than would be considered for a gate valve. This is possible because a cone valve, when open, presents a smooth bore to flow of water. Very little hydraulic loss is produced by one reduction in diameter.

The cone valve shows up to best

advantage in operation. On one line in Newark, N. J., 48-in. valves require the services of six to eight men when operated manually. This crew requires about eight hours to close or open the valve by 450 turns. Five years ago a 24-in. cone valve was installed in the line; it can be operated by one man making 72 turns in a few minutes.—*Laurie M. Leedom, construction engineer, Division of Water, Newark, N. J.*

FILTER MATERIALS

Proposed specifications for filter media prepared by the association's committee on filtering materials do not state that certain sizes of sand and gravel shall be furnished. The engineer using the specifications must decide what material sizes are to be employed in filter design.

To assist in determining sand and gravel size, values used in several filter plants as well as the general range and limiting ratios of diameters commonly used are cited. Several sand sizes are listed and the purchaser can use either sieve sizes or relate particle size to stated percentages when writing project specifications. Tables covering both arrangements are included.

A simple procedure for gaging hydrochloric-acid solubility is included in the specifications. While the proposed method is not adequate for the accurate determination of acid solubility, it is considered satisfactory for purchase purposes. It can be carried out in the simplest of laboratories.

The appendix includes data on anthracite coal and a brief comparison of sand and coal as filtering media. —*Richard Hazen, committee chairman and consulting engineer, Malcolm Pirnie Engineers, New York, N. Y.*

OPEN-AIR RESERVOIRS

Evidence collected by the committee on open distribution service reservoirs indicates that quality of water in open service reservoirs leaves much to be desired. In addition, the data shows that most waters are frequently tested before entering open service reservoirs but not enough tests are made after discharge from storage.

Where open service reservoirs exist, the question of establishing facilities to re-disinfect water re-entering the distribution system is a very vital issue. In the opinion of the committee such a procedure must receive serious consideration regardless of cost.

All engineers consulted thought that all open distribution reservoirs should be covered. Some experts stipulated that this should be done only when practical and reported that it is not feasible to cover many existing reservoirs.—*Norman J. Howard, committee chairman* and *director of water purification, Toronto, Canada.*

CATHODIC PROTECTION

Two types of electrical devices are used for mitigating corrosion in steel water-storage tanks. One device—the conventional cathodic-protection installation—involves use of direct current from an external source, impressed on either a suspended sacrificial or non-sacrificial anode, that flows through the corroding medium (water) to the tank wall. Superimposed on the tank wall the electric current stifles flow of current resulting from electrochemical corrosion.

The other protective system employs a series of electrical resistances attached to the outside wall of the tank. A direct current applied from an external source flows through the resistances into the tank wall to counteract corrosion.

To determine degree of protection obtained in bare-wall steel tanks with an aluminum anode carrying an applied external potential, a galvanic magnesium anode and an electrode-less circuit with an applied external potential, three experiments were carried out. As a control, a fourth tank was afforded no protection.

The effect of cathodic protection on dissolved oxygen content of the stored water was checked using a stoneware crock as a control.

Experimental results showed:

1. Use of a properly installed sacrificial aluminum anode provided with an external potential prevented corrosion of a bare steel surface.

2. Use of a properly installed sacrificial galvanic magnesium anode inhibited corrosion of a bare steel surface despite initial, aggressive attack.

3. The electrode-less circuit, often mistakenly referred to as cathodic protection, showed no protection against corrosion.

4. Dissolved-oxygen concentrations in stored water did not increase when sacrificial anodes of the galvanic type (magnesium or aluminum) with an applied external potential were used. —*Peter E. Pall, assistant sanitary engineer, Hackensack Water Co., New Milford, N. J.*

Cities Wage War On Rats

With rat populations outnumbering human residents, some 400 cities are participating in a rat-control drive initiated by the U. S. Department of Interior, the American Municipal Association reports.

Rats cause an estimated $2 billion property damage in the nation annually—more than $13 per person. In addition, the rodents carry diseases, such as bubonic plague, typhus, trichinosis, and rat-bite fever.

New York City's rat population is estimated at 8 million, more than its total of human inhabitants. Annual rat damage in the city is estimated at $18-45 million. The city health department has trained 75 inspectors as specialists in rodent control to spearhead the local war on rats.

Philadelphia has earmarked $82,000 for this year's be-mean-to-rats campaign. Officials in Philadelphia and elsewhere warn that simply trapping rats is not enough. Three methods of extermination are being emphasized: Poisoning, cutting off food supply, and closing up refuges.

Denver has half a million people and an estimated 600,000 rats. The city is one of 31 in the nation being used by the Department of Interior to demonstrate that it is much cheaper to get rid of rats than to continue paying for the damage they cause. Officials have set up 20 rat-poison stations throughout the city.

Most cities are using red squill, a new poison, as the prime weapon against rats. Generally it is being supplied at cost to home owners.

An increasing number of cities are passing rat-control ordinances which set standards for rat-proofing buildings and require property owners to take action.

Optical Theodolite Speeds Dam Survey

C. O. Greenwood, Jr.

Engineer, Sacramento District Corps of Engineers
Sacramento, Calif.

The surveyor can make all settings and take all readings without moving around the instrument.

OPTICAL-READING theodolites employing direct reading and optical centering principles have been used to advantage in executing triangulation nets for dam location in the Sacramento District, Corps of Engineers. Surveyors were able to perform second and third order triangulation in less time and with greater accuracy than is considered standard when conventional transits or theodolites are used.

The Swiss-made Wild "T-2" theodolites were originally procured for use by engineer troops to extend fire-control in battle zones, and to establish horizontal and vertical control for tactical maps. Very compact, simple to operate and highly accurate, the instruments are readily adaptable for civil use.

This type of theodolite, devised by H. Wild, Swiss optical scientist, has been manufactured in European countries for some years. During the war American concerns made similar instruments for Army use.

The telescope, though very small, has the same magnifying power and light-gathering properties as an average transit. Angle divisions are scribed on glass plates and read through a magnifying ocular. Simplicity of operation is obtained because all readings can be taken without requiring the instrument man to move from his position.

High accuracy on control nets

One of the first projects on which these instruments were employed by the Sacramento District was triangulation of the Isabella Dam site on the Kern River in California. All observations on the triangulation net were made during daylight except along two lines where reflected sunlight from nearby telephone poles produced horizontal refraction. These last observations were made at night.

Two base lines were measured on the Isabella work, one 1,402,720 ft. and the other 1,322,812 ft. The first was measured four times with a probable error of 1 in 470,000, and the second three times with a probable error of 1 in 1,100,000. The length of one base line as computed from the other through eight unadjusted triangles varied only 0.018 ft. from its measured length.

At each station, six pointings were made with the telescope direct and six in the reversed position. This resulted in twelve triangles with plus closures and nine with minus closures for the 21 triangles in the main scheme. The average closure was 3 sec. and the maximum 8 sec. Simultaneous adjustment of the entire net resulted in an average correction of 2 sec. to all observed angles. Three decimal places were carried in computing distances to provide significant figures commensurate with angular measurements.

The extreme accuracy indicated by the foregoing results may be subject to challenge as being of no practical value. This accuracy certainly would not be expected and seldom could be attained by using conventional American-made transits and theodolites unless considerable extra time were spent in taking readings. However, such results are regularly expected in work with this instrument even though only ordinary precautions observed.

Angles cannot be doubled

The Wild instrument differs functionally from the ordinary transit—or repeating theodolite—in that there is no lower motion and, thus, angles cannot be doubled. Hence the theodolite is properly defined as a direction instrument. In this regard, it is similar as to function to first order theodolites as known in this country, but is radically different in design.

The differences are apparent in following through the process for measuring horizontal angles.

The horizontal circle is a glass disk some 2½ in. in diameter. This is accurately graduated to 20 min. of arc and is numbered every degree. Prisms are so set in the instrument that, by looking through a magnifying ocular alongside the telescope, opposite sides of the horizontal circle can be seen simultaneously. By turning a micrometer knob after the telescope is set on the target, images of the lines scribed on opposite sides of the horizontal circle are brought into coincidence. For example, the 0 and the 180 degree lines are made to coincide—the reading thus noted is combined with the reading on the micrometer drum.

By this method, angles can be read to one sec. as easily as reading a clock. Opposite sides of the circle may be read at one time, eliminating errors due to eccentricity in the vertical axis.

To read the vertical circle, the same ocular is used. A knob shifts the prisms so the vertical circle—a glass plate similar in size to the horizontal circle—can be read.

When the telescope is pointed straight up, the vertical circle reads zero. This gives vertical angle readings in terms of angles from the zenith instead of plus or minus from a level plane, lessening the probability of error by eliminating the danger of forgetting a plus or minus sign or by reading a vernier in the wrong direction.

Another advantage of this instrument is optical centering. By looking

through a prismatic eyepiece near the leveling screws, the point over which the "gun" is being set can be accurately centered in a small circle scribed on a glass reticule in the eyepiece. This eliminates the use of a plumb bob for accurate work and prevents error induced by wind action.

In making a set-up the tripod is first placed over the point and roughly centered by use of a plumb bob. The instrument is then clamped on the tripod and the plumb bob removed. Rough level is obtained by a circular level mounted near the leveling screws, and the optical plummet is then used to obtain reasonably accurate centering. Now the instrument is accurately leveled by means of one horizontal level tube and the three leveling screws, the centering operation is repeated and the instrument is ready for measurement of horizontal and vertical angles.

Compact instrument

The Wild theodolite weighs only 12½ lb., compared with the standard 8-in. theodolite weight of 23 lb. Even with the carrying case, the Wild instrument weighs only 17 lb. Compact design also makes the instrument steady in wind.

Primary drawback is in maintenance and repair. Dustproof construction minimizes routine cleaning, but when this is necessary, expert optical mechanics must do the work. Some field repairs can be made on the ordinary transit in an emergency, but field repairs are impossible on the Wild theodolite and competent repairmen are few and far between. American instrument repair shops have repaired and adjusted these instruments, but, since their best technicians must be assigned to this work, it is an expensive job.

Another drawback is first cost—all must be imported since cost of manufacture here would be prohibitive. American concerns (such as Keuffel & Esser and W. & L. E. Gurley) made such instruments during the war but cannot compete in price with foreign-made instruments and no plans have been forthcoming for U. S. commercial manufacture.

Instruments of this type have been made by the Zeiss Co. in Germany, the Tavestock Co. in England and Kern & Co., Aarau, Switzerland.

Sewage-Reclamation Practice Needs Independent Engineering Concepts

Water reclamation from sewage should be completely divorced from sewage disposal and considered as an independent operation. When this concept has been adopted by engineers, the door to safe, acceptable water reclamation from sewage will be unlocked, A. M. Rawn, chief engineer and manager, Los Angeles County Sanitation District, told a recent meeting of the California section, American Society of Civil Engineers.

Reclamation of sewage from water is being practiced throughout the country, said Mr. Rawn. He pointed to the fact that effluent from small sewage-treatment plants and thousands of septic tanks and cesspools "leaches into underground strata to be re-used as domestic, agricultural and industrial supply."

Recovery of an acceptable effluent from a disposal plant is generally incidental to an imposed sewage-treatment process and is seldom the primary factor influencing plant design, Mr. Rawn continued. Cesspools and septic tanks are products of necessity, he said, and "their contribution to the neighborhood water supply is usually disregarded or, at least, not discussed in polite circles."

In a review of sewage reclamation (*Sewage Works Journal*, Jan. 1948), only three small sewage-treatment plants designed and operated to recover effluent are mentioned. These are: Herington, Kansas; Grand Canyon, Ariz.; and Golden Gate Park, San Francisco.

When domestic sewage is used as a raw material, the authority of state health departments undoubtedly will be applied. It was questioned whether state regulations relating to sewage disposal are applicable to water reclamation. The two operations differ greatly and the difference must be recognized by health authorities if public prejudice against sewage-treatment plants is not to be extended to water-reclamation projects.

Resistance of the public to water reclaimed from sewage or to consumption of crops known to be irrigated with sewage effluent is another potent barrier to be overcome, Mr. Rawn declared.

Where sewage is to be used for agriculture, industry or recharge of ground waters, the treatment plant must be designed to dispose of all solids as well as oxidize and perhaps sterilize the effluent. The plant must process all of the sewage flow as and when it arrives, regardless of condition, temperature, strength or other detrimental characteristics.

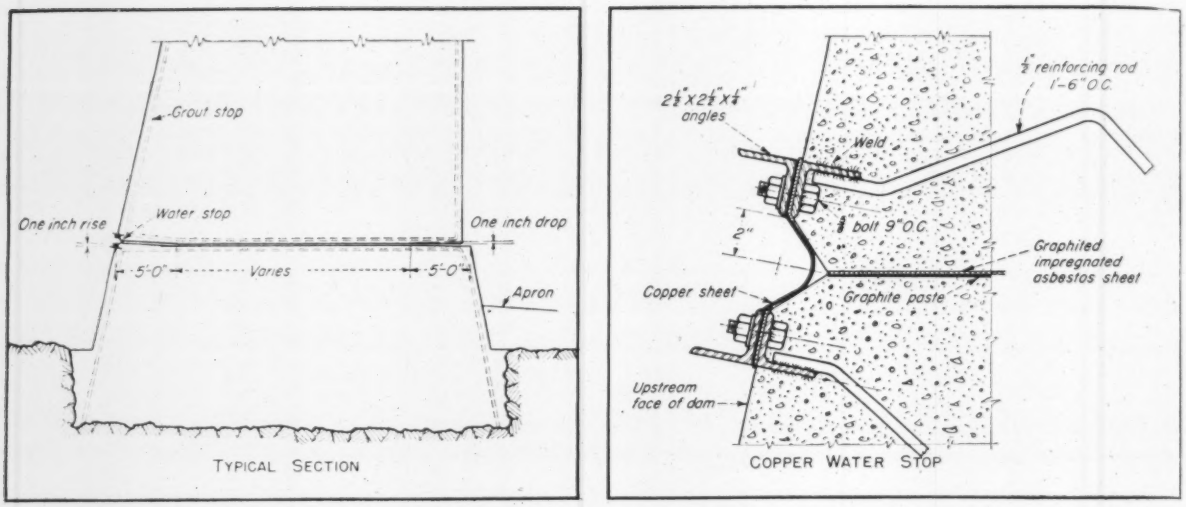
In contrast to this, a water-reclamation plant using domestic sewage as a supply (not a part of the sewerage system) need not dispose of solids removed. The solids could be returned to the sewerage system. This arrangement would eliminate much of the odor nuisance and reduce construction and operating costs considerably.

Another advantage would be that the reclamation plant could be operated only when advisable or when the character of sewage would not render treatment ineffective, Mr. Rawn said. It would not be necessary for the plant to handle sewage quantitatively as it arrives or to retain liquor and sludge detrimental to reclamation.

More than any other factor, necessity will probably influence state health officials to authorize use of sewage for production of water supply, he advised. Past experience indicates that necessity has been the controlling factor in granting favorable decisions for borderline cases.

"Direct re-use of water reclaimed from sanitary sewage as a domestic supply," Mr. Rawn declared, "is unthinkable." It is doubted that the public will ever support use of sewage as domestic supply even if the end product was completely pure.

In concluding, Mr. Rawn declared that many decisions concerning water reclamation must be made. For example, he listed several questions, the answers to which are now being sought in Los Angeles County: "Who is to pay for reclamation? Who is to receive the benefit from reclaimed water? Where and how is it possible to mingle the reclaimed supply with other potable sources? And what is the relative value of reclaimed water in the overall water-supply picture?"



***AN ARCH SECTION** of Matilija Dam in California rests on a gravity section base and is separated from the base by a shear plane. Detail at right shows an unusual copper water stop on the upstream face which prevents water from entering.*

Horizontal Shear Plane Separates Gravity and Arch Sections of Dam

A SHEAR PLANE to permit relative movement between the arch section and the underlying gravity section is a feature of the design of Matilija Dam recently constructed for the Ventura County Flood Control District in California. The original design called for arch-dam construction from bedrock to crest, but deflection calculations indicated that with the reservoir filled to flood level (12 ft. above crest) movement of the center of the dam just above the base would be some ¾ in.

Because the base portion was restrained and could not move that much, the slip-joint was installed so that the top 154 ft. of the dam acted as an arch and the bottom portion (about 35 ft. at the center) had a gravity section. Construction work was impeded by unforeseen foundation difficulties, which required extensive changes in the abutment and foundation design, thus considerably increasing the cost of the work.

Located on Matilija Creek near Ventura, Calif the dam was built to provide protection from flash floods, which had caused considerable damage, in 1938 and 1941, and also to conserve available water. The dam is some 190 ft. high and has a crest length of 620 ft. Except for the gravity section at the base, it is designed as a variable-radius arch, with thickness varying from 8 ft. at the crest to some 32 ft. near streambed level.

Reservoir capacity is 7,000 acre-ft., and the annual safe yield is expected to be 4,000 acre-ft. This safe yield is high in comparison with the capacity since the average flow in Matilija Creek is 28,000 acre-ft.—four times the reservoir capacity. Low flow of record is 1,950 acre-ft. and, although this came at the end of a 4-year dry spell, use could have been made of 4,000 acre-ft. per year for all but two months of the fourth year.

Shear plane relieves stress

Although the dam is relatively small, the design of the shear plane and water stop is believed to be significant. Necessity for the shear plane was caused by the U shape of the canyon in which the dam is located. Deflections at or near the base of an arch dam located in a V-shaped canyon are negligible. However, where a U-shaped canyon is involved, relatively large deflections result near the base, which, because of rapid, non-uniform change in width, could cause a horizontal crack to develop. A shear plane allows movement, and thus no stresses are set up that might result in failure.

The shear plane was located at El. 971 or 154 ft. below the spillway crest. A float finish was made on top of the gravity section, and imperfections ground smooth. Over this, a layer of graphite paste was spread to a thickness of about $\frac{1}{16}$ in. Sheets of graphite-impregnated asbestos fiber, ⅛ in. thick, were spread on top of the graphite paste. Openings between adjoining sheets of asbestos were filled with graphite paste, and building paper was placed over these openings to prevent intrusion of concrete during subsequent pouring operations. A thin layer of concrete was first carefully placed to insure non-movement of the asbestos sheets and building paper. Metal grout stops were placed just above and below the shear plane to protect it further.

The upstream 5 ft. of the shear plane has a 1-in. rise and the downstream 5 ft. has a 1-in. drop. These changes from a direct horizontal plane are intended to prevent friction from spalling the concrete near the

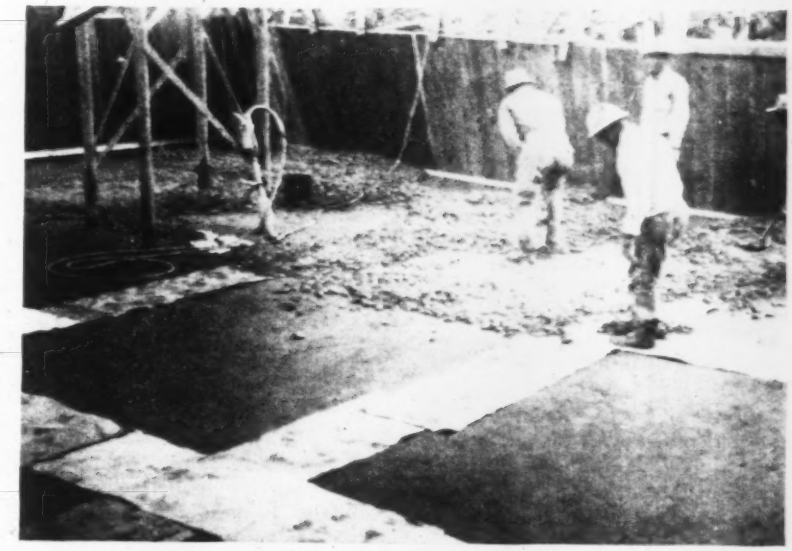
faces of the dam when movement occurs.

At the upstream edge, the shear plane was protected from intrusion of water from the reservoir by a copper water-stop. The design of this stop detail is believed to be new, and engineers who have inspected the installation feel that it will effectively perform its intended function.

Tests were made on various materials considered for use in the shear plane, and the combination of asbestos and graphite paste showed an average frictional coefficient of 0.1 sliding and 0.2 for static friction. For design purposes, a factor of 0.3 was used.

Using this factor, the overturning moment of the gravity section became the moment of the water pressure on its face plus 0.3 of the moment of the weight of the arch section acting parallel to and at the plane of the top of the gravity section.

To protect the downstream foundation of the dam, a concrete apron 6 ft. thick was placed so that it would blanket part of the downstream spilling basin—the apron extending beyond the limit of the overflow nappe at maximum flood stage. The spillway crest varied from El. 1125 for the two center sections to El. 1127 for the outside sections of the spillway. It was designed as a direct overflow spillway and is capable of accommodating 60,000 cfs. Maximum flood of record is 15,900 cfs. and this occurred on Mar. 2, 1938.



***STRIPS OF BUILDING PAPER** protect the joints between the graphite-impregnated asphalt, as the first concrete is placed on top of the shear plane.*

***CONCRETE** for the upper portion of the dam was poured from a steel trestle.*

Local financing

The dam was built for and is being financed by the county of Ventura by means of a county-wide flood control district organized under an enabling act of the California State Legislature. An ad valorem tax of 20 cents per $100 assessed valuation is allowed for operating expenses and bond interest. Bonds voted by the people are to be redeemed by revenue from sale of water and, if that is not enough, by direct taxation. Purpose of the work was to prevent damaging floods in the stream which flows through the city of Ventura, Calif. A second and equally important purpose was to conserve water for use by the city. During the winter of 1947-48, water for domestic purposes was scarce because of an unusually dry winter, and Ventura city officials were forced to pass restrictive ordinances prohibiting waste of water. Had Matilija Dam been storing water, say, since the previous winter, sufficient supply may have been available.

Possibility of such a water shortage prompted the county board of supervisors to retain a consulting engineering firm to render a report soon after proper legislation was enacted. Its study, submitted in 1945, recommended immediate construction of Matilija Dam. Bonds were approved, and final designs were made, with a contract being let in June, 1946. It was hoped that some water from the 1946-47 runoff season could be stored.

Because of the urgency of the construction due to water scarcity, the engineer recommended that the project be started without an exact determination of the depth of overburden in the streambed. Other geologic conditions were expected to be suitable for an arch dam, on the basis of geologic reports. The formation consists of vertical strata of relatively firm Eocene sandstone so situated that each abutment of the dam would be supported by a different stratum. Because the strata were vertical, core drilling was not believed necessary.

It was later found that overburden in the channel near the right abutment was some 20 ft. greater than expected. The extra excavation involved

delayed construction and caused increased cost. Early winter flash floods also delayed construction with the result that no water could be stored during the winter of 1946-47.

Further difficulty was encountered during construction on the left abutment. Excavation for the abutment revealed a soft lens of shale extending well under the dam. The lens was later mined out and replaced with concrete. Work was stopped until the full extent of the soft area could be determined and revisions made in the design.

A review of the entire project was also undertaken with various outside consultants called in. At this time a geologist pointed out that no test borings had been made and that the trouble may have been predictable. Other geologists had previously (and subsequently) indicated that borings would have added little to the information already on hand.

The original plans had shown an increased thickness of concrete at the abutments to reduce the unit stresses on the supporting sandstone. As a result of the restudy of the design, additional thickness was provided to reduce these stresses further.

Grout holes increased

The original plans had also called for grout holes in the underlying material to a depth of 25 ft. This involved some 1,400 lin.ft. of holes which, on reconsideration of the design in view of conditions encountered, was increased to some 9,000 ft.

Needless to say, this extra work increased the cost considerably. The original estimate was about $800,000, and the low bid on a unit basis was $1,235,000. Total cost of the completed project will be more than $2,200,000. The delays in construction and the increased cost have caused much local discussion and resentment. Adding emphasis to this is the fact that Matilija Dam is located only a few miles from the site of the 1928 St. Francis Dam disaster.

Engineers on the project were the Donald R. Warren Co., Los Angeles, who called in J. P. Buwalda, of California Institute of Technology, as geologic consultant, and W. P. Creager, Buffalo, N.Y., as special consultant. Robert L. Ryan, Ventura County engineer, was appointed to the additional duty of engineer for the Ventura County Flood Control District sometime after his return from wartime duty as a Navy Seabee commander. Chas. P. Berkey, Columbia University, served as geologic consultant for the county during the restudy of the design. The State Division of Water Resources was represented by W. H. Holmes, supervisor of dams, and W. A. Perkins, engineer. Engineer consultants for the state were W. L. Huber and F. C. Herrmann, both consulting engineers of San Francisco, and geologic consultant was Chester Marliave. Construction was a joint venture of the Guy F. Atkinson Co., W. E. Kier Construction Co., and Bressi-Vevanda Constructors, Inc. John A. Kier was project manager for the contractor.

Responsibility for Waste Treatment Urged as Industry Duty

Top management must assume complete responsibility for eliminating industrial pollution of the nation's streams and rivers, Dr. Mark E. Putnam, vice-president, Dow Chemical Co., Midland, Mich., told a regional meeting of the American Institute of Chemical Engineers which met at Cleveland, Ohio recently.

Pointing to current agitation for more stringent legislation, Dr. Putnam suggested that "if we of industry prefer to meet our problems with as little regulation as possible, we had better be about it." A survey of individual problems and remedial program planning in close cooperation with state control commissions should be the first order of business, he suggested.

Apart from the legal side of the question, the Dow official declared that industrial pollution has equally important public relations and economic aspects. "Since our inland waterways, large or small, are deemed to be public property," he said, "we cannot escape the conclusion that when we damage that water or render it less fit for use by other members of the public, we are taking undue advantage of our own rights as a corporate citizen."

This, he said, constitutes a serious public-relations problem which, if not adequately remedied, can injure the standing of a company in its community and encourage the activities of anti-pollution pressure groups such as sportmen's organizations. He urged that industrial managements not attempt to combat such groups but meet as reasonable men and arrive at a mutual understanding of, and solution to, divergent problems.

Dr. Putnam said that industries using surface-water supplies are finding an increasing problem because their source water is polluted and must be treated. He suggested it would be much more appropriate for each company to clean up its own wastes than to be forced to clean up its supply. Frequently, waste elimination turns out to be much less costly than anticipated because in the effort processes may be made more efficient or valuable materials salvaged.

Many companies, such as those of the chemical industry, will have a continuing problem, the speaker acknowledged, because of their continuing entry into new fields of manufacture, bringing new materials, new processes and new wastes to be dealt with. He added, however, that any industrial-waste-disposal program is long range in nature and that both public and law enforcement agencies should be made aware of the complexity of the problems involved.

Waste recovery is economical

Treatment of metallurgical wastes can be incorporated into an overall economical system, H. D. Unwin, Albert Kahn Associated Architects and Engineers, Inc., Detroit, Mich. stated. Taking as an example the ball bearing plant of the New Departure Division, General Motors Corp. at Sandusky, Ohio, Mr. Unwin described how sulphuric acid pickling waste is not regarded as a waste but is used to treat the alkali-cleaning wastes and chromium-plating wastes.

Another feature of this plant is the use of separate tanks for collecting each type of waste. Each tank is large enough to hold a 24-hr. collection of waste so that the treatment plant need be operated only 8 hours a day.

Notes on Legal Decisions

Summaries of decisions relating to construction prepared by I. Vernon Werbin, counselor at law and engineer, New York

Introduction—From time to time, Engineering News-Record *will publish summaries of important court decisions bearing on issues that arise frequently in connection with engineering or construction work, as well as abstracts of recent decisions that appear to be of special significance to engineers and contractors. The author of these summaries has had experience both as an engineer in charge of construction and as an attorney handling cases involving the interpretation of construction contracts. He is author of "Legal Phases of Construction Contracts."*

Damages Due to Delays Caused by the Owner

A contractor generally can recover damages if his performance has been delayed by act or omission of the owner. This rule rests on the owner's implied obligation to maintain conditions so that the contractor can complete the work within the specified time.

Contract provisions expressly exempting the owner from liability will be given full effect. The language of such provisions usually is given a strict interpretation because of the harsh results that may flow from the enforcement. But, where it is clear that a given result comes within terms of the provision, the fact that the result is a harsh one will not prevent the application of the rule[1].

A contract provision "that no claim shall be made or allowed the contractor for any damages which may arise out of any delay caused by the United States," was held to be a "plain and unrestricted covenant on the part of the contractor, comprehensive as words can make it, that he will not make any claim against the government for any damages which may arise out of any delay caused by the United States[2]."

A contract provided that no claim for damages should be made by the contractor for delays caused during the progress of the war. The New York Court of Appeals held that this did not bar an action for damages resulting from acts of the other party that prevented the contractor from starting the work within the time set forth in the contract[3].

A delay may be so unreasonable as to constitute a breach of the contract[4].

Where the contract provides that if the work is delayed by acts of the owner or by other specified causes, the contractor will be granted an extension of time in which to perform, such extension is the sole remedy available to the contractor. He will not be entitled to recover the actual damages sustained by reason of such delays[5].

Contingency items in a bid are assumed to provide for continuing costs while the job is delayed. If contingencies do not occur they are paid for anyway by the owner. It seems to be the best interest of both owner and contractor to eliminate one-sided provisions from the contract[6].

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(1) Erickson v. Edmonds School Dist. No. 15, 125 P.(2d) 275.
(2) Wells Brothers Co. v. United States, 254 U.S. 83, 65 L.Ed 148.
(3) Cauldwell-Wingate Co. v. State, 276 N.Y. 356, 12 N.E. (2d) 443; Wright-Kremers, Inc. v. State, 263 N.Y. 615, 189 N.E. 724.
(4) Harwood-Nebel Const. Co., Inc. v. United States, 105 Ct. Cl. 116.
(5) United States v. Howard P. Foley Co., 329 U.S. 64, 91 L. Ed. 135.
(6) J. J. Kelly Company v. United States, 107 Ct.Cl. 594.

Damages Resulting from Delayed Performance

Where proof of the actual damages suffered from delay in the performance of a contract is impracticable or difficult to determine, courts favor reasonable agreements for payment of liquidated damages. However, where the amount stipulated as liquidated damages bears no relation to the probable damage from delay, courts will decline to enforce the provision on the ground that it is a penalty rather than compensation for the actual damage sustained. Where the provision for damages is reasonable, it is valid and enforceable although damage is not proved.

Where a party seeking to enforce a provision for liquidated damages is partly responsible for the delay, the contract provision will not be enforced. Where both parties are at fault, the courts will not attempt to apportion the delay caused by each[1].

To overcome rulings that provisions for liquidated damages will not be enforced where the contracting party has contributed to the delay, many contracts provide for time extension equivalent to the period of delay[2]. Under such stipulations, the contractor usually must immediately give written notice of any claim; failure to give such notice may result in loss of the time extension unless conduct of the owner could be construed as a waiver of the contract requirement[3].

Contracts very often provide that if the contractor fails to make proper progress the owner shall have the right to complete the work and hold the contractor liable for the excess cost. Generally this right and the right to hold the contractor liable for liquidated damages are alternative remedies. If the owner elects to take over the work and complete it at the expense of the contractor, he waives his right to recover liquidated damages for delayed performance[4]. But, parties are free to make any contract provisions they wish[5].

Where delay results from the owner ordering extra work, there can be no recovery of damages for such delay[6].

It is proper for parties to agree in advance on the amount of damages to be paid in event of a breach of contract. Where damages are uncertain in amount, the parties have a right to say how much should be paid by way of compensation to the injured party. Where parties fix their own obligations with knowledge of what damages would reasonably flow from a breach of the contract, there is no reason for a court to try to improve on it[7].

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(1) United States v. Kanter, et al., 137 F. (2d) 828.
(2) Robinson v. United States, 261 U.S. 486.
(3) Trauts-Realty Corp. v. Casualty Co. of America, 166 N.Y.S. 807.
(4) United States v. Cunningham, 125 F (2d) 28.
(5) Miller et al. v. United States, 106 Ct Cls. 239.
(6) Ramsay v. Gatlin Const. Co. v. Vincennes Bridge Co., 50 F.(2d) 600.
(7) Callanan Road Improvement Co. v. Colonial Sand & Stone Co. Inc., 72 N.Y.S (2d) 194, and cases there cited.

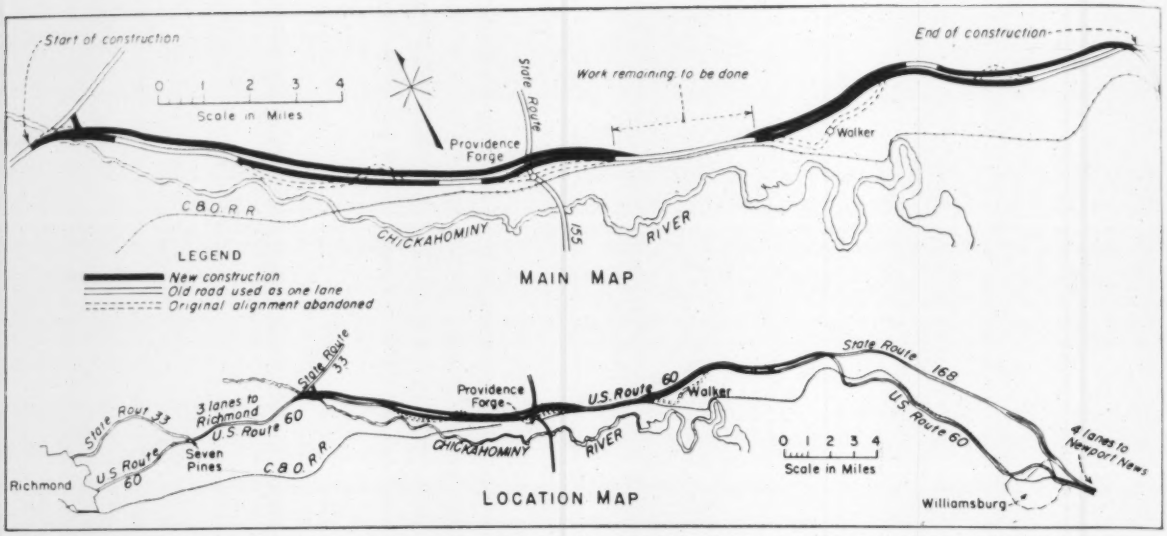


Fig. 1. About 21 miles of U. S. Route 60 between Richmond and Williamsburg is being rebuilt as a divided highway.

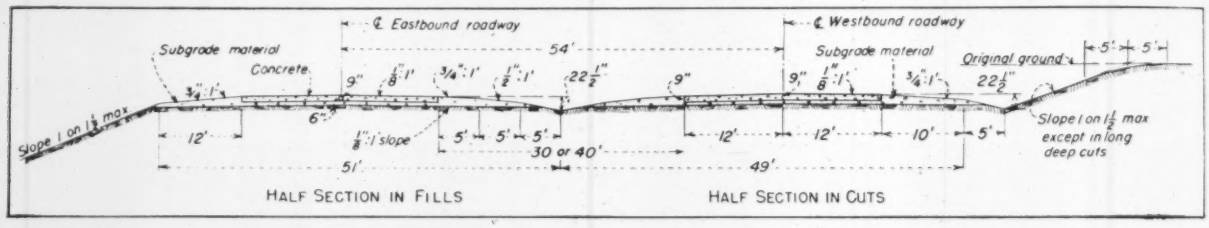


Fig. 2. Typical cross-section of the rebuilt highway. The median zone is not fixed in width, being 30 or 40 ft. wide for much of the distance, and of varying widths elsewhere depending on physical conditions.

Virginia Reconstructs U.S. Route 60 As Dual-Lane Divided Highway

To PROVIDE a better route for the extremely heavy travel between Richmond and the Hampton Roads area, 25 miles of U. S. Route 60 are being reconstructed by the Virginia Department of Highways as a dual-lane divided highway. Nearly $3,000,000 of work has already been awarded to improve nearly 21 miles, leaving four additional miles to be reconstructed. When completed, this route will be Virginia's longest divided road.

The section being rebuilt extends from the point 12 miles east of Richmond where U. S. 60 and State Route 33 divide (Fig. 1) to within about 11 miles of Williamsburg, from which point two good highways—U. S. Route 60 and State Route 168—extend onward to the Hampton Roads district. The highway traverses lightly rolling terrain with the predominant soil types sandy clay and loam, which erode rapidly.

The old road was built in the early 1920's, being surfaced in part with an 18-ft. concrete pavement and in part with a surface-treatment bituminous pavement. A few years ago a plant-mix asphalt surfacing was laid over both the old pavements.

Alignment along the old road was poor in many places, and as the traffic frequently exceeds 5,000 vehicles per day, with peaks of 450 per hour, accidents were frequent.

Two 24-ft. roadways built

The new construction is the largest project now in progress in Virginia, with the exception of the Shirley Memorial Highway leading south from Washington, D. C. (*ENR* Dec. 6, 1945, vol. p. 754, and Dec. 12, 1946, vol. p. 780). Two 24-ft. portland-cement concrete roadways are being built at most locations, with the old roadway being used for eastbound traffic on a limited mileage.

The grassed median strip between the two roadways is normally made 30 or 40 ft. wide and is never less than 5 ft., which is the width used at bridges. At some points a width of about 100 ft. containing trees is provided. Grassed shoulders 10 ft. wide are provided in cuts, and on fills the width is increased to 12 ft. All new slopes are to be treated with vegetative planting.

Fig. 3. With this train of equipment, the Rea Construction Co., Charlotte, N. C., as a subcontractor, built 2,016 ft. of 24-ft. pavement in 12½ hr., which established a new paving record in Virginia. Excellent progress was also made on other sections. Curing of the concrete is with a membrane compound sprayed on the pavement.

Designed for a maximum speed of 70 mph., the new highway has an excellent alignment. The sharpest horizontal curve is 4 deg., and the minimum sight distance on vertical curves 800 ft. Maximum grade is 4 percent, which compares with 6 percent on the old road.

Final choice for the new pavement called for a 9-in. thick slab, reinforced for crack-control with a single layer of 6x12-in. mesh of No. 4 gage wire placed 2 in. below the upper surface. Expansion joints are inserted at 90-ft. intervals, and contraction joints are formed every 30-ft., load-transfer dowels being employed at both types of joints. The joint filler is a mixture of 85-100 penetration asphalt and 15 to 25 percent stone dust.

Concrete designed for a minimum compressive strength of 3,000 psi. at 28 days is specified and maximum size of the aggregate—normally river gravel—is limited to 2-in. dia. material.

To date, most of the concrete has been produced with portable 34-E dual-drum pavers traveling outside the forms. Both lanes of a roadway are constructed simultaneously, with the new slabs of each lane sloping away from the center-line of the roadway at a rate of ¼ in. per ft.

All fills compacted

Fills for the new highway are built in 8-in. layers which are required to be compacted until 95 percent of maximum density at optimum moisture is obtained. Selected material is used for both the subgrade and shoulders, a 6-in. layer being required below the pavement. This material must have a liquid limit below 35 and a plasticity index not above 12.

Both the outside drainage ditches and those along the center of the depressed median zone are paved on the steeper grades. Two types of paving are used in these ditches, either precast concrete blocks with open joints that will permit grass to grow between the block, or 4-in. thick slabs of concrete.

Only one major bridge was required. This structure spans the Chickahominy River at a point where two entirely new roadways were required. Designed for an H20-S16 loading, this crossing consists of five 40-ft. simple reinforced-concrete, slab-and-girder spans. Two 26-ft. roadways separated by a 5-ft. median strip are provided.

Major contracts awarded for the project in 1946 and 1947 were secured by: Bero Engineering and Construction Corp., Hampton, Va.; Nello L. Teer, Durham, N. C.; H. W. Scott, Franklin, Va., and Hechler Bros. Co., Richmond.

C. S. Mullen is chief engineer, and T. F. Loughborough is state construction engineer for the Virginia Department of Highways. Plans are prepared under the direction of A. H. Bell, location and design engineer, and Wm. R. Glidden, bridge engineer. P. W. Snead, district engineer at Petersburg, is supervising construction on the western end of the project, and J. M. Hagan, district engineer at Suffolk, is in charge of the eastern section.

M. B. Kinnikin is district engineer for Virginia for the Public Roads Administration.

Household Sewage-Disposal Studies Will Evaluate Design and Operation

COMPREHENSIVE studies to develop and collate information on the design and operation of individual sewage-disposal systems are now being conducted by the U. S. Public Health Service, in conjunction with the Housing and Home Finance Agency.

Aims of this research project, as well as the procedures employed to collect basic data on septic tanks, subsurface drains and appurtenant devices were described by S. R. Weibel, sanitary engineer of the USPHS water and sanitation investigations station, Cincinnati, Ohio, at a recent meeting of the Texas Public Health Association.

Objectives of the research program, worked out in conference between representatives of the Federal health service and the housing agency, are:

1. Collection and analysis of existing data. This includes a review of domestic and foreign, published and unpublished literature, governmental regulations and commercial brochures on design, capacity, operation and materials of construction of septic tanks and disposal systems.

2. Study of existing installations to determine operating characteristics.

3. Short-term research on commercial septic tanks to determine efficiency of sedimentation, adequacy of sludge storage, and the effects of capacity, size and shape.

4. Construction and operation of septic tanks with flexible controls under normal conditions for pilot studies.

5. Construction and experimental operation of subsurface drainage systems.

6. Sampling, gaging and testing of representative installations.

7. Laboratory studies on soil-clogging characteristics of tank effluent.

8. Study of economic feasibility of building septic tanks with 10- or 20-yr. sludge capacity.

9. Study of the functional effect of freezing on a properly built subsurface disposal field and determination of how design practice should be modified for cold climates.

10. Study of effect of root growths on disposal systems.

11. Determination of effect of garbage grinding on septic-tank operation and of design changes required to permit this service.

12. Testing distribution boxes to determine most efficient design.

13. Investigation of feasibility of changing ratio of horizontal to vertical area in septic tanks to permit less detention and greater sludge storage.

14. Determination of effect of grease on septic action and efficiency of disposal systems.

15. Determination of relation of sodium and calcium to soil-clogging action of tank effluent.

16. Investigation of relationship of: lateral and vertical seepage; evaporation; and transpiration to overall efficiency of subsurface disposal.

17. Investigation of new methods of disposal, particularly subsurface methods.

18. Development of minimum design standards for septic-tank systems.

Technical publications examined

The first step, examination of published data, was started early last year. Some 600 references from world-wide sources have been examined but very few of the sources revealed factual studies.

Most of the items covered design and construction practices, with limited observations on individual sewage-disposal systems. "The story," Mr. Weibel says, "is one of confusion and conflict of opinion."

An interesting experience uncovered concerns the 19th century work of a Frenchman, John Louis Mouras. At a dwelling in Vesoul, France, Mouras built a masonry tank to receive sewage, kitchen wastes and rain water before disposal in a cesspool. After twelve years of use, he found that the tank was almost free of solids. Mouras then collaborated with Abbe Moigno, a scientific authority of that time, in conducting a series of septic-tank experiments. As a result of these studies, Mouras patented a tank in 1881. (The first septic tank appeared in this country about 1883.)

Among the institutions that have investigated household sewage disposal are: The University of Illinois, Massachusetts State Department of Health through its Lawrence Laboratory, Kansas State College, and Michigan Department of Health. Work at the first two institutions is being continued.

Design of septic tanks is being studied at the University of Michigan under a National Institute of Health research grant. Introduction of sewage into soil will be investigated at Rensselaer Polytechnic Institute under a similar grant.

The second step, study of existing disposal systems in operation, was started in Feb. 1947 with examination of individual plants in the Dallas, Texas area. Observations by field engineers also are being made in suburban areas of Kansas City; Cook County, Ill.; South Bend, Ind.; Kalamazoo, Mich.; Cincinnati, O.; Warwich County, Va.; Montgomery, Ala.; and Miami, Fla. Data collected from field surveys are being tabulated to compare and evaluate the relation of various factors and to study rough measures of performance.

Septic tanks being tested

The third step, short-term research on septic tanks and subsurface drains, began in June, 1947 when a laboratory and an experimental battery of eight tanks were set up at the Cincinnati investigation station.

Twelve full-size tanks are now in operation. These include: a 2,000 gal. rectangular unit of a type recommended by a joint committee (see "Rural Sewage Disposal," *Public Health Reports*, Mar. 12, 1943); eight

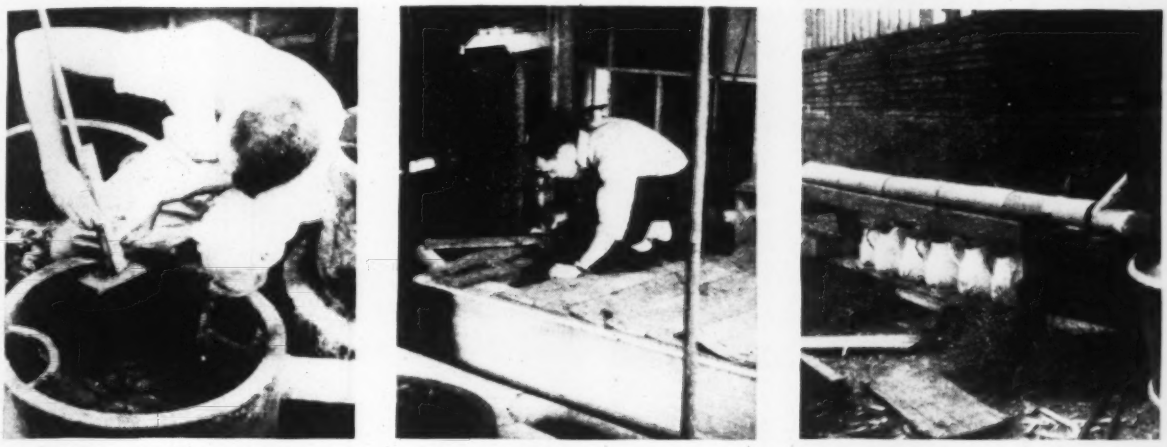


Fig. 1. Scum formation in one of the 24-in. vertical septic tanks is measured (left). The top of sludge deposits are located with a sight tube fitted with a flashlight bulb just below the window in the end of the tube (center). Distribution of flow through tile-line joints at various grades, openings and flows is tested in an above-ground installation.

500-gal. tanks, including a horizontal cylinder, vertical cylinder, two- and four-compartment vertical cylindrical, oval, rounded end, and two rectangular. Joint-Committee type, one of which receives ground garbage in addition to sewage; two units, one- and two-chamber, small vertical cylindrical; and a three-compartment horizontal cylindrical.

Three 500-gal. rectangular tanks with one, two and three chambers each, together with a single-chamber unit of the same plan dimensions but with a three-ft. depth, are being readied for operation.

The twelve tanks, Mr. Weibel reports, are dosed eight times daily in rotation from 7:00 A.M. to 10:30 P.M., seven days a week. This operation is carried out from a distribution chamber equipped with a stirring device and large enough to feed the twelve tanks once from a single batch. Sewage from a nearby residential area is delivered to the central dosing tank. Samples are taken before the tanks are dosed.

All tanks receive equal dosages but the eight daily feedings are varied in a definite pattern. This pattern was established on the basis of metered use of water at several households of staff members.

Effluents from all tanks are collected in individual receptacles after each feeding. Daily composites are then prepared for analysis.

After initial seeding with sludge, the septic tanks were fed with 500 gpd. of sewage. When sludge depths were increased by adding sludge from tanks in the field, this dosage was decreased to 250 gpd.

Operation of the tanks in parallel, Mr. Weibel suggests, will provide a basis for comparison of shapes and effectiveness of solids removal. Sludge accumulation in respect to time and number of contributory persons will be determined from field inspection.

Laboratory studies are in progress

In the laboratory the following investigations are underway: Effect of salts discharged from home softeners; aspects of tank seeding; introduction of sewage through sludge; and bacteriological aspects of clogging in sand columns under aseptic conditions by application of pure cultures obtained from tank effluents. In addition, analytical methods for working out clogging criteria are being explored.

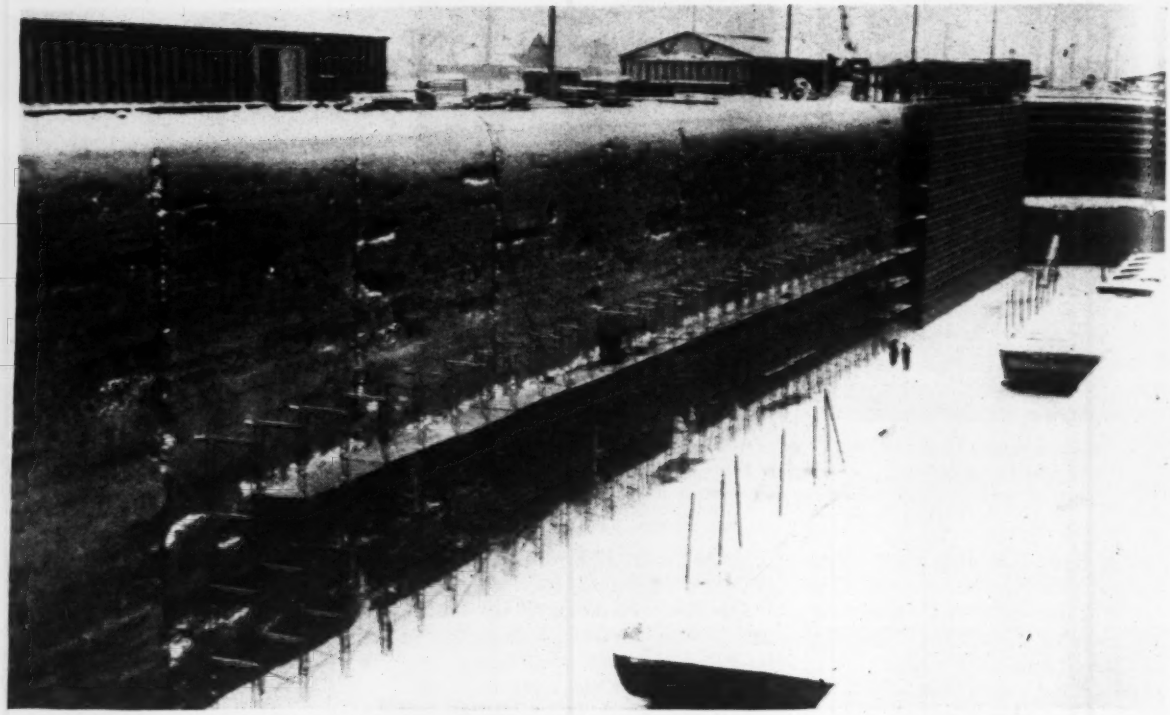
To study field absorption, six 50-ft. subsurface drains with various grades, widths and trench cover have been installed on the station grounds. These lines are dosed with effluent from one experimental septic tank. The amount of the dosage was established from percolation tests. Additional disposal lines will be built this spring.

Individual sewage systems in the Cincinnati area are being sampled and gauged by an automatic device on the effluent pipe. The work is carried out over a two-week period at each installation. As experimental trends develop, sampling and gauging activity will be expanded to test findings in the field.

Distribution characteristics of tile lines at different gradients, joint spacings and loadings are being studied in above-ground layouts.

Fig. 2. Sub-drainage tests are conducted on six 50-ft., 4-in. tile drains with 6 in. of gravel above and 2 in. below the pipe. The trench is 18 in. wide and about 24 in. deep.

In conclusion, Mr. Weibel told that the work of soil scientists on absorption, as well as local experiences with the effect of freezing on shallow subsurface systems, are being coordinated with the research program. He expressed the hope that local health departments could be contacted soon to gather data on control practices and difficulties in connection with individual sewage-disposal plants.



THIRTY-FOUR-YEAR-OLD WALL of Davis Lock gets a new gunite concrete facing despite last winter's sub-zero weather.

Wintertime Guniting at the Soo

After 34 years of weathering and abrasive wear-and-tear from waterborne traffic, the south wall of Davis Lock at Sault Ste. Marie, Mich. was given a new facing of reinforced gunite concrete last winter. Wintertime repair of the Soo locks is nothing new for the U. S. Engineers, since a large part of this work necessarily must be done between shipping seasons.

What makes this particular repair job noteworthy, however, even for a guniting job, was the well-planned procedure and sequence of operations that protected the fresh concrete from freezing temperatures which reached —23 deg. F. Even the old wall was heated before deteriorated areas of concrete were chipped off.

Some 750 ft. of lock wall, 50 ft. high, was re-faced with gunite concrete sprayed on over wire-mesh reinforcement anchored to the old concrete. All work was performed by government equipment and forces, using hired labor.

Following the close of the shipping season last fall, four 84x30-ft. temporary sand-and-cement houses were erected along the top of the lock, a short distance back from the wall to be repaired. They were stocked with a total of 11,600 bags of cement and 1,600 cu. yd. of sand, with provisions for heating when the temperature dropped below freezing.

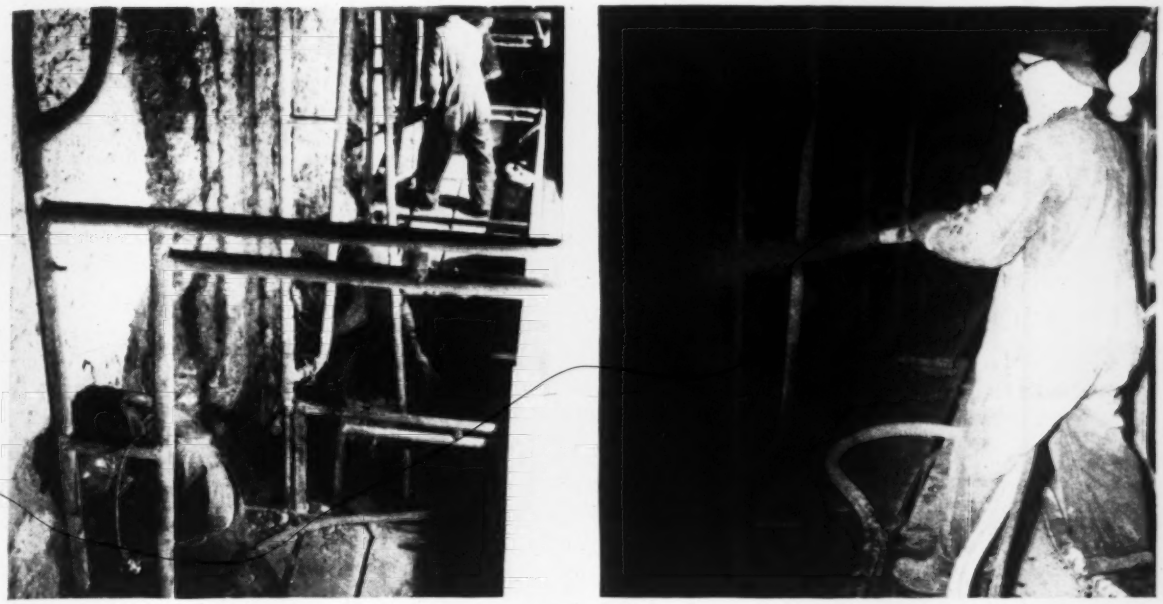
Steam furnished by derrick boat

Next, tubular steel scaffolding, 58 ft. high and 400 ft. long, was erected on the floor of the lock, about 1 ft. from the face of wall. The scaffolding and 400 ft. of timber framing across the top of the wall was enclosed with canvas, and the entire working area of wall heated with steam supplied by the U. S. derrick-boat Paul Bunyan, anchored just outside of the lock. Steam from this floating plant also heated the cement, sand and mixing water.

Initial chipping of the old concrete was started at the bottom of the wall. After it had been carried up a few feet, the chippers moved to the top of wall and worked down to avoid interference later from falling debris. Loose and deteriorated concrete was chipped off the old wall to a depth of 3 to 30 in. by an 8-man crews, working three 8-hr. shifts.

Each 5-in. layer of gunite concrete was reinforced with 4x4-in. No. 6 wire mesh anchored to the old concrete with $\frac{3}{8}$-in. self-expanding bolts spaced 3 ft. apart horizontally and 2 ft. vertically. In addition, pockets over 5 in. deep were reinforced with a network of $\frac{3}{4}$-in. deformed dowel bars grouted into the old wall. Depth of gunite concrete to be applied was indicated by control wires fastened to the ends of the anchor bolts.

Bleeder pipes were inserted in holes drilled through the old wall, with adjacent cracks caulked, to collect and discharge seepage water away from the fresh concrete. After completion of the job, bleeder pipes were cut flush with the new facing. After all chipping was done on a section of the wall, and reinforcement



***THE REMOVAL** of deteriorated old concrete, by chipping, (at left) and application of reinforced gunite concrete, (at right) were performed inside the enclosed tubular scaffolding.*

hung in place, the entire area was cleaned with compressed air just prior to guniting.

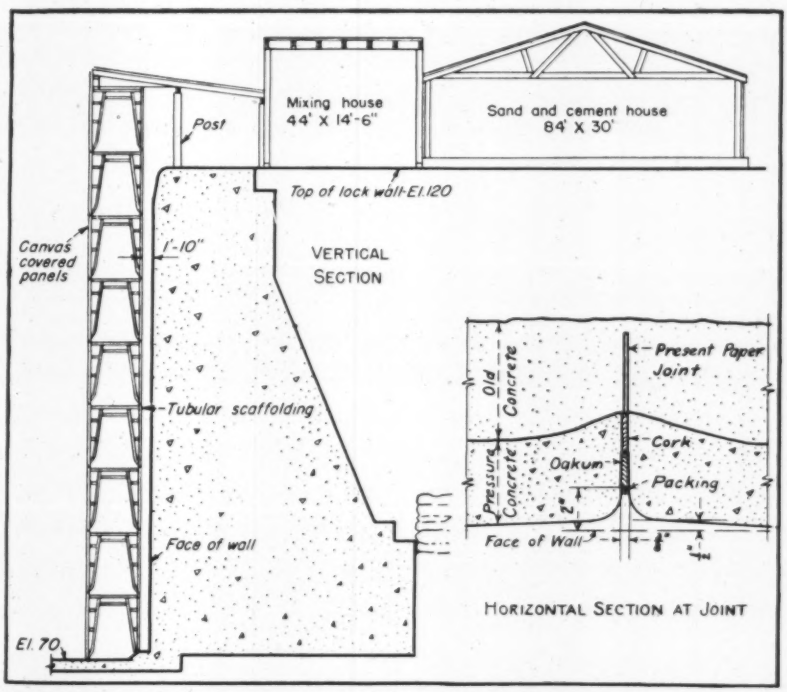
Cement and sand for the gunite concrete was mixed dry in a small electric mixer operating in a portable 44x14½-ft. mixing house located between the sand and cement houses.

The mixed sand and cement was screened to remove aggregate over ¼-in. and charged into a bin at the gunite machine. Mixing water was introduced into the pressure gunite line about 9 in. from the nozzle—the rate of application being controlled by the nozzle man, based primarily on the color of the gunite concrete being produced.

In general, the gunite concrete, designed for 6,000-psi. compressive strength at 28 days, was applied in 4- to 5-in. layers at one application. The lower 5 ft. of wall was gunited first, then the operator moved up to the top of the wall and worked down. Finished surfaces were not troweled smooth, but were either scraped with the edge of a trowel or given a final flash coating of gunite concrete.

Cork and oakum expansion joints were placed vertically at 30 ft. intervals in the new facing of gunite concrete to match existing joints between the monolith sections of the old wall. Joint material was held in place with special steel lining strips temporarily bolted to anchors set in the old concrete. The completed gunite concrete facing was sprayed with a membraneous curing compound and steam cured for seven days.

All work was under the jurisdiction of the Detroit District, Corps of Engineers, Col. A. Riani, district engineer. J. E. Harns, engineer in charge, St. Mary's Falls canal, had general supervision of the work, which was under the direct charge of Bert G. McCarthy, project engineer, assisted by James Lipsett.



***CANVAS-ENCLOSED** tubular steel scaffolding and continuous timber decking over lock wall were steam-heated to protect chipping and guniting operations. Portable mixing house gave direct connection to steam-heated sand and cement houses.*

Superstitions in the Building Field

S. F. Borg
Assistant Professor, Postgraduate School
U. S. Naval Academy Annapolis, Md.

***Editor's Note**—Down through the ages and in all lands there have been many superstitions having to do with construction. Some of them continue to this day; for example, the belief that it brings good luck to place a green bough on the top of a building when the highest point is reached. In this article Professor Borg, who has made a study of the subject, discusses superstitions of special interest to civil engineers and constructors. In perusing this article, probably it is well to bear in mind the definition of superstition as "an excessive reverence for, or fear of, that which is unknown or mysterious; hence the attitude of mind of a person whose beliefs are regarded as false and as leading to idle and foolish practices."*

MANY inhabitants of northern Europe are convinced that it is unlucky to be the first person to cross a new bridge or enter a new building. To do either of these things, they say, invites certain death, and within a short time.

To account for this superstition, we consider a fable which has cropped up in many parts of the world, with slight variations, during the last two thousand years. It tells of a builder who had contracted to build a bridge (for a building the story is similar) within a certain period of time with a heavy completion penalty clause. Three days before the specified completion date, the bridge is only half finished and it appears impossible to complete it on time.

At this point the contractor invokes the aid of the devil, the bargain being that the unholy one would complete the bridge on time in exchange for the first living thing to cross the bridge. We wonder at the contractor's consideration in this alleged contract! However, the bridge is completed on time, and the story usually concludes by saying that, following completion of the job, the contractor drove a rat or a chicken across the bridge, while the devil raged. This story has come down even to this day, and many a cautious peasant will forgo the honor of being the first to cross the bridge just in case anything happens.

Fig. 1. Sarah Winchester, the original owner of this strange house in the Santa Clara Valley of California, believed that she would not die as long as her house was unfinished. For 38 years builders worked on it, adding annexes, lean-tos and secret passages. Nevertheless, she died and the present owners exhibit the grotesque structure as a haunted house.

About cornerstones

When we attend a cornerstone-laying ceremony today, few of us realize that this ceremony is a more innocuous form of a custom which started ages ago and required that cornerstones be laid in human blood. In early days it was thought that the Earth God would not support a new structure unless proper sacrifice was first made, and that usually meant human sacrifice. This superstition held well into the Middle Ages. Even to this day, upon razing an ancient structure in Europe, the wrecker occasionally finds a human skeleton built into it.

As an example of a related superstition, in the Middle Ages the engineer on a foundation job had one sure, simple solution for a settling wall. He would simply change the plans and specifications to call for the body of a young human being to be built into the wall. Apparently, this was common standard practice, for to this day many houses, in many lands, are supposedly haunted by these young sacrificial victims.

In some parts of Europe and in this country as well, architectural treatment of a building will call for gargoyles (Fig. 3) or perhaps just round balls on slender rods to be

placed around the roof of the building. A related treatment sometimes seen in Europe calls for special roof-ridge tile pieces with small sculptured horses astride the ridge.

To account for these, we remember that the roof of a building is subjected to wind loads and it was the wind which caused many an ancient roof failure. Consequently, sacrifices had to be made to the Wind God, Wodin or Odin. The horse was an animal sacred to many ancient people and therefore horses were customarily sacrificed to Wodin, and as a reminder of this, their heads were set on posts nailed to the roofs. The tile-ridge pieces mentioned are a modern adaptation of this sacrificial custom.

In addition, in the old days the heads of human victims were used instead of heads of horses. Later peoples, not quite as bloodthirsty as their predecessors, did away with the sacrifices but carried on with the motif. Hence, the gargoyles and balls, both of which are reminders of the human heads.

The triumphal arch

The triumphal arch (Fig. 2) is a structure common to many lands. Today when victorious soldiers march through the arch, they are merely following the ancient superstition which led to the building of this strange structure. For, in the olden days, it was held that soldiers returning from a successful war were subject to many hostile influences and temptations. The only way to combat these was to cleanse the mind and the soul thoroughly. Upon marching through the arch, the soldier was, symbolically, reborn and hence immune to the dangers about him.

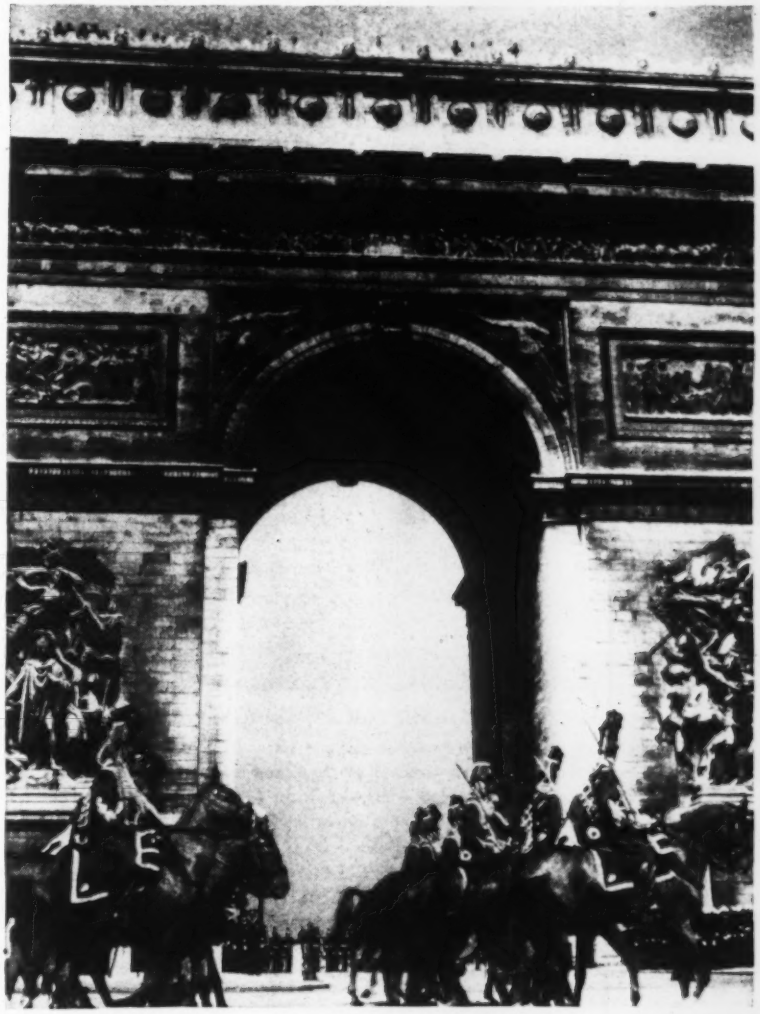


Fig. 2. This is the famous Arch of Triumph in Paris as it appeared on the 100th anniversary of its completion. It was once believed that victorious returning soldiers were subject to many hostile influences which were cleared away when they marched through a triumphal arch.

Fig. 3. Gargoyle on Notre Dame Cathedral, Paris.

Just as a door is the means of human entrance into a house, so also, the ancients believed, the door is the opening through which death, the furies and all other undesirable ones enter a house. It was necessary, therefore, that some provision be made for keeping them out of the house. What better way than to frighten them so that they would be afraid to enter?

The usual procedure was to place a pair of sculptured lions or other animal or half-animal, one on each side of the door. The more frightful the form the more likely the unwanted one would be kept away. These may still be seen at the entrance of Egyptian temples and palaces; and many homes, libraries and buildings in this country are treated architecturally in this manner.

The shape and form of modern household hardware is due somewhat to an ancient superstition. For example, when we lift a door-knocker made to resemble a human or animal form, we are handling a symbol which was also introduced as a guardian of the portal.

Readers are invited to submit for publication additional superstitious practices or beliefs related to civil engineering.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

PAVED SLOPES USED FOR VIRGINIA BRIDGE

Because it was expected to give much better service and since the contractor agreed to build it for the same price, a concrete slab—instead of the riprap originally specified—has been used to protect the slope of the approach embankments for a new bridge on State Route 89 south of Galax, Va. The completed pavement is shown by the accompanying photo. The slab was made 8 in. thick and is non-reinforced, being built in 8-ft. sections.

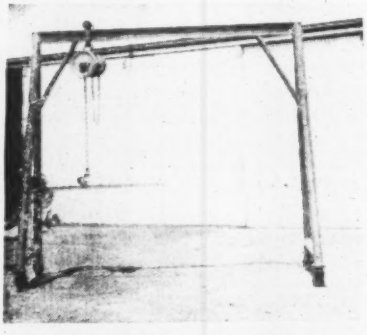
W. E. Graham and Sons Co., Cleveland, N. C., was the prime contractor for the entire project, subletting construction of the bridge to McDowell and Wood, Roanoke, Va. The bridge, which spans Chestnut Creek, was built by the Virginia Department of Highways for which T. F. Loughborough is construction engineer and Wm. R. Glidden, bridge engineer.

Shop-made Derrick on Twin A-Frames Speeds Truck Repair

To speed engine replacement and removal of oil tanks from trucks, the O. M. Slasson Trucking Co., Long Beach, Calif., uses a shop-made, manually operated derrick that, when carrying a heavy diesel engine, may be easily rolled about the shop or yard by one man.

The 13-ft. high derrick consists of a 6-in., 14.75-lb. I-beam supported at the top of two A-frames, 13 ft. apart. The legs and top and bottom cross pieces of the A-frames are made of 3-in. iron pipe. Pipe knee braces 2-in. in diameter, between the I-beam and top cross piece of the frames, prevent distortion during movement.

A caster, 9 in. in diameter and 2 in. wide, on each leg of the A-frames permit the derrick to be rolled in any direction. Casters are held in yokes made of $\frac{1}{2}$-in. steel plate. Rings welded above and below the top horizontal plate of the yokes provide adequate rotational bearing for a very short vertical shaft. The end of the shaft is machined down to fit into a hole in the top plate of the yoke and ring below it. Around the hole the annular area of the machined section bears against the top plate. Additional vertical bearing for the full shaft section is furnished by the ring on top of the plate.



A manually operated rolling derrick consisting of a chain hoist, 6-in. I-beam and A-frame legs made of 3-in. pipe speeds truck repair.

To the top of the shaft is welded a $\frac{1}{2}$-in. horizontal steel plate. This plate is bolted to a similar shoe welded to the bottom of the A-frame leg. The shafts were made from Model A front-wheel spindles.

A twin-wheel roller on the top flange of the I-beam carries a chain hoist under the beam by a U-shaped hanger made of $2\frac{1}{2}$x$\frac{1}{2}$-in. flat iron. Sides of the hanger hold the roller on the beam. Rollers, 4-in. in diameter, are used to permit easy movement of heavy loads.

All pipe connections were arc welded with $\frac{3}{16}$-in. reverse-polarity electrodes. Pipes at the top of the A-frames were notched to permit insertion of the I-beam flush with the outside of the pipe. This construction provides a saddle rest and eliminates need for additional bearing plates. A single pass with $\frac{3}{32}$-in. electrode on both sides of the joint connected the beam to the pipe frame.

Included with the derrick is an auxiliary device to remove truck transmissions or rear ends. Two small lugs of $\frac{1}{2}$-in. iron are arc welded to the top of a lower cross brace. A $\frac{5}{8}$-in. hole in the lugs provides a bolted connection for a 3-ft. vertical member made of $2\frac{1}{2}$x$\frac{1}{2}$-in. iron. By means of a yoke and bolt a 6-ft. cantilever arm, made of the same stock, extends inward from the top of the vertical member. A series of holes in the vertical strip permit the cantilever to be used at various heights.

A loop of $\frac{3}{8}$-in. round stock is welded to the top center of the cantilever. The hook from the chain hoist is set in the loop to raise or lower the cantilever carrying a load by a loop and sling at the free end.

With the exception of the chain hoist, all parts of the derrick were built of discarded equipment. Charles Campbell designed and built it.

Using the mobile derrick, one mechanic working alone can install or remove a five-speed truck transmission.—HARRY KERWIN, *San Luis Obispo, Calif.*

Allis-Chalmers photo

SCREEN ABOVE BULLDOZER BLADE ADDS PUSHING SURFACE

Mounted above the blade in an angle-iron frame, a heavy screen provides additional pushing surface without obstructing vision for a bulldozer used by the Richmond (Calif.) Sanitary Service to handle 400-500 cu. yd. of refuse daily. The frame is bolted to the top of the moldboard and braced to side arms of the blade.

GOT A GOOD GADGET?

Kon Tractor: "Joe, what's that set-up for?"

For Mann: "To test grouted-in bars used to anchor the spillway slab to the rock."

K. T.: "Did you make it?"

F. M.: "Yes, out of a hydraulic jack, a short I-beam, and a strong clamp. The blacksmith made the clamp."

K. T.: "It's a good idea. You ought to write it up and send it with a photo to ENR. They pay five bucks for such stuff."

F. M.: "A snapshot wouldn't show all the details. Maybe the field engineer would make up a sketch for me."

K. T.: "Sure he would."

F. M.: "Who did you say to send it to?"

K. T.: "Send it to the

Field and Office Editor
Engineering News-Record
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New York, 18, N. Y.

CAMERA MEMORANDUM

In building a new bridge, the Florida State Road Department now indicates at one end of the structure the loading for which the bridge was designed. Started a few years ago, this practice is expected to aid maintenance crews and operating forces of the department.

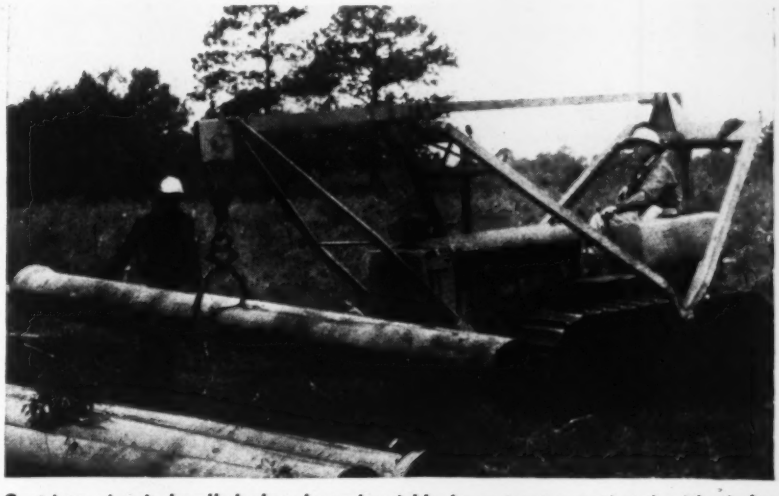
The procedure was introduced by E. S. Fraser, bridge engineer of the department. The photo illustrates the marking used for a new suspension bridge over the Suwannee River.

Tractor Lifts Water Pipe

A simple and ingenious rig mounted on a tractor helped C. A. McDaniel, a southern contractor, lay a 12-in. cast-iron water main for the Bureau of Yards and Docks, U. S. Navy Department at Beaufort, South Carolina.

The rig consists of an extension to the steel framework which normally actuates the bulldozer blade, and a pair of tongs for lifting pipe. The tongs were improvised from a pair of timber-lifting hooks by welding curved steel pads to the ends of the tongs. To prevent damage to the pipe surface, these pads were faced with automobile brake lining, riveted to the plates.

Thus equipped, the bulldozer handles, stacks and lays pipe quickly and cheaply.—W. Mack Angus, *Brooklyn, N. Y.*



Cast-iron pipe is handled cheaply and quickly by a tractor equipped with timber tongs fitted with curved steel plates covered with brake lining.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Pumped Storage

Sir: As the article "Economic Possibilities of Pumped Storage Hydro-Electric Plants", by N. N. Wolff, (*ENR*, Apr. 29, vol. p. 631) mentions only one South American pumped-storage plant, the one at Maitenes, Chile, it might be well to call attention to the present and projected use of such storage, on a large scale, by the Brasilian Traction, Light & Power Co. This company supplies electric power to Rio de Janeiro, Sao Paulo and an area contiguous to those cities of about 12,000 sq. mi., serving at least 800,000 customers with an installed generating capacity of nearly 700,000 kw. The following is taken from the company's 1945 report.

"The Paraiba-Pirai project. . . . permits about 675,000 hp. additional firm power at 60 percent load factor to be obtained by consecutive (construction) steps in the Lages plant and 135,000 hp. in the Lages auxiliary plant (when built) by *diverting and pumping* up to *60 metric tons per second* from the Paraiba River above Barra to Pirai via a 3½-mile tunnel, the Pirai River valley and the Vigario pool canal and tunnels, into the Lages plant, extended as needed. Thus by elevating this water about 135 ft. in the Santa Cecilia and Vigario pumping plants, whenever power is available, this water becomes available (for power generation) in a total head of 1,125 ft. at any time when the system needs the power. The same Lages units can use water also from the Lages reservoir, now being enlarged to a capacity of 1,100,000,000 metric tons. The various units will be installed as needed, over a long period of years, and regulating reservoirs on the upper Paraiba rivers will be added toward the close of this period when needed.

"This installation, serving primarily the Rio de Janeiro region, will also operate advantageously with the much larger Serra do Cubatao installation, (at Santos) which serves primarily the Sao Paulo region. *The latter uses similarly the method of pumping through* low heads (up to 200 ft.), storing over long periods and then dropping through very high heads (over 2,280 ft.) the excess waters of the upper basin of one tributary, the Tiete, of the Parana and River Plate. Such long range planning on a large and economical scale is essential to the rational development of the great hydro-electric resources of these industrial regions of Brazil."

It is here noted that the utilization of pumped storage for the Sao Paulo region has been in progress for a number of years. The first pumping unit (6,500 hp.) went into operation as far back as September, 1940, at the Triacao pumping plant and much larger units have since been added. The work in the Rio region necessary to utilize pumped storage may have been delayed due to post war conditions and the organization of conservative financing of the improvements.

CHARLES JAY SEIBERT,
Washington, D. C.

Improved Tainter Gates

Sir: The article "Tainter Gates of Simplified Design" by D. A. Buzzell (*ENR* April 1, vol. p. 500) was most interesting. The old fashioned tainter gate which had the skin or face plate spanning vertically, supported on horizontal beams or channels, had the virtue of being able to vary the spacing of the horizontal beams. As the water pressure decreases on the face plate from the bottom to the top of the gate, the horizontal beam spacing is increased, thereby obtaining uniform stress in the face plate which was a constant thickness.

At the first glance at the new gate design, this saving seems to be eliminated, as the face plate spans horizontally on vertically placed tees. But this article did not tell that varying thicknesses of face plates are used on this type of gate. Some gates are apportioned into three parts vertically, the bottom plate being ⅝-in. thick, the middle section, ½ in. thick and the top section ⅜ in. thick. It is seen that as the stress in the plate becomes smaller from less loading, a thinner plate is substituted.

The saving in weight using this type gate is most interesting. Recently a consulting engineering firm on power plant design bought for a client company five of these old type gates for a 30-ft. head. They used "photolithos" of a gate designed in 1930 for 16,000 psi. If a 30-percent saving in weight as indicated in the article is realized, it would pay this firm, as well as the client, to throw away their old designs and tracings and start fresh with the new design. It is interesting to note that in 1930 this firm paid $45,000 for five gates, while in 1948 the contract for five similar gates was let at $133,000. With prices rising in this magnitude, it is imperative that even for a small number of gates the steel be designed for utmost economy. It is hoped that the U. S. Engineers in the future will give us reports on this type of gate, in the manner of watertightness, maintenance and general economies.

Besides the saving in weight, another advantage of using this type is that the hoisting machinery, motor and power requirements should be a lot less.

The anchorage for these new type gates is passed off with one paragraph. This type of anchorage is heavier than I have used, but it does have the advantage of placing the load near the upstream end of the pier. Perhaps Mr. Buzzell can give us a typical anchorage detail as used with these gates, with a notation as to how provision is made for uplift on the tension beam.

As these gates are welded, and therefore should be very stiff in comparison to a riveted gate, the writer fails to see why side rollers are used. There are usually two rollers on each side of these gates, placed opposite the lower and the upper arms. These rollers are set with a clearance of ¾-in. each side. As these gates are raised by two chains, fastened at the bottom of the gate near the sides of the gate, the writer cannot see how this gate can get out of line, as the chain hoists are interconnected with each other. On riveted gates framed in the old manner, with which the writer is familiar, rollers are not used, and as far as the writer knows no trouble has arisen from the lack of these rollers.

In regard to the rubber side seal, commonly called a "mutton chop" or "music note" seal, the writer would like to have more information. From his own limited experiments and from data from others he has found that the coefficient of friction of this type seal on carbon steel is about 1.1. The coefficient of oak on carbon steel used on the old type gate is usually taken as 0.75. As lifting capacity of hoist is partially a function of this friction, larger friction values will mean greater hoist capacity. The writer would also like to get some data on the wearing qualities of this type seal.

The profession should be much indebted to the U. S. Engineers and Mr. Buzzell for bringing this type of gate to their attention.

THEODORE B. RIGHTS
Consulting Engineer
Roselle, N. J.

A Simpler and Better Venturi Tube

Sir: Mr. Stevens has yielded to a very universal urge to produce a cheaper and hence "better" Venturi tube (*ENR* April, 1948, vol. p. 658). I have also yielded to the same urge but tests of many hundreds of flow nozzles and venturi tubes has brought me back to the form originally suggested by Clemens Herschel in *Trans.* American Society of Civil Engineers, 1887.

This Venturi tube (Fig. A) has a cylindrical, non-corrosive throat of length equal to the throat diameter. Taps are located at or near the throat center. The long radius from the upstream conical section precludes any contraction in the throat.

Mr. Stevens' Fig. 2, "Conventional Venturi tubes" is like nothing "in the heaven above, the earth beneath or the waters under the earth." If there were a contraction in the conventional Venturi tube as suggested, it would increase the Venturi head and decrease the coefficient. But in Fig. 7 the coefficient of the conventional tube is over two percent higher than his tube.

A glance at Fig. B, which is one of many hundreds of Venturi-tube calibrations, will show a maximum deviation of experimental points of ± 0.1 percent and a probable error of almost zero.

Similarly, the maximum deviation in Fig. 6 is about ± 2 percent with the points widely scattered. This is attributable either to the design of the tube or the laboratory work. I suspect it is the former. I cannot think of a worse place for the throat tap than at this flow-direction change.

A comparison of the value of the coefficient in Fig. B with the family of curves in Fig. A, gives very close agreement.

Any Venturi tube under low pressure and high velocity or Venturi head will cavitate but this condition is very exceptional.

Mr. Stevens' tube has the virtue of cheapness but when the customer insists on an error of ± 0.1 percent in a calibrated tube, such a scatter of points shown in Fig. 6 would be unsatisfactory.

Therefore, I consider Mr. Stevens' tube and many similar ones, my own included, to be no improvement over the design originally suggested by Herschel and adhered to by the two principal Venturi-tube manufacturers in the United States.

W. S. PARDOE
Professor of Hydraulic Engineering
University of Pennsylvania
Philadelphia, Pa.

EDITORS NOTE: Further critical comment on Mr. Steven's article, by Charles G. Richardson, vice president of Builders-Providence, Inc., will appear in a forthcoming issue.

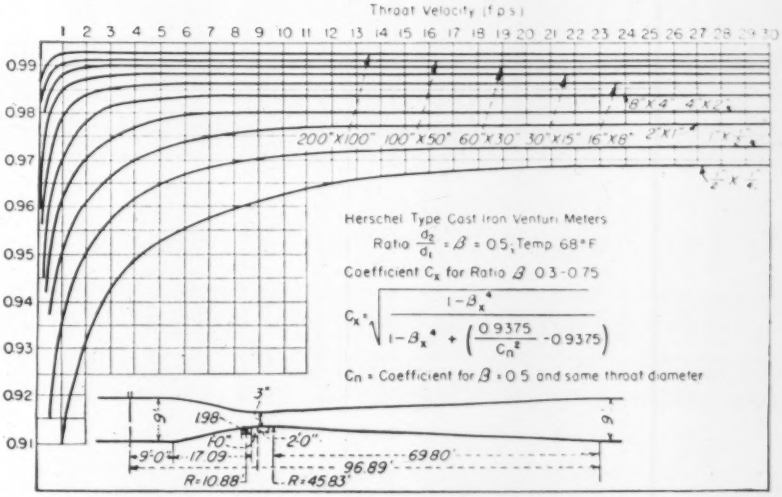

Throat Velocity (f p s)
Herschel Type Cast Iron Venturi Meters
Ratio $\frac{d_2}{d_1} = \beta$ = 0.5, Temp 68°F
Coefficient C_x for Ratio β 0.3-0.75
$C_x = \sqrt{\frac{1-\beta_x^4}{1-\beta_x^4 + \left(\frac{0.9375}{C_n^2} - 0.9375\right)}}$
C_n = Coefficient for β = 0.5 and same throat diameter
R=10.88"
R=45.83"
96.89"
69.80"

Fig. A. Coefficients for Venturi tubes made by Builders-Providence, Inc., Providence, R. I., and Simplex Valve & Meter Co., Philadelphia, Pa., have been found from innumerable investigations.

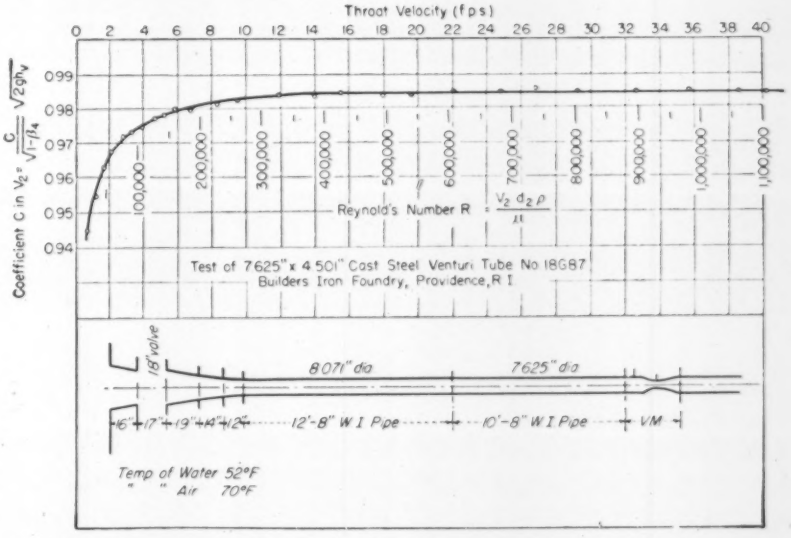

Throat Velocity (f p s)
Coefficient C in $V_2 = \frac{C}{\sqrt{1-\beta^4}}\sqrt{2gh_v}$
Reynold's Number R = $\frac{V_2 d_2 \rho}{\mu}$
Test of 7.625" x 4.501" Cast Steel Venturi Tube No 18687
Builders Iron Foundry, Providence, R I
8.071" dia
7.625" dia
12'-8" W I Pipe
10'-8" W I Pipe
Temp of Water 52°F
" " Air 70°F

Fig. B. Calibrations of Venturi tubes show a maximum deviation from test points of ±0.1 percent and a probable error of almost zero.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Apartment House Design

APARTMENT HOUSES—By Joseph H. Abel and Fred N. Severud. 280 pp. Reinhold Publishing Corp. $10.

Data of value to those concerned with the design of multi-story apartment houses are presented in this book. It consists of three part. Part 1: Architectural Design was written by Joseph H. Abel and deals with site planning, building types and requirements, layout of rooms and building materials. Part 2: Structural Design was prepared by Fred N. Severud and covers floor framing systems, wall construction, and prevention of cracks in masonry. In Part 3, Chapter 1: Heating and Air Conditioning was authored by Clifford Strock; Chapter 2: Elevators, by H. M. Nugent and W. H. Easton, Jr.; and Chapter 3: Landscaping, by Alfred Geiffert.

Practical Soil Mechanics

SOIL MECHANICS IN ENGINEERING PRACTICE—By Karl Terzaghi and Ralph B. Peck. 566 pp. John Wiley & Sons, New York 16; Chapman & Hall, London. $5.50.

Arranged for easy use of parts of the book without having to become an expert in the theory of soil mechanics, this work has an almost down to earth flavor compared to earlier books by the senior author. It is divided into three sections: Problems of Design and Construction; Physical Properties of the Soil; and Theoretical Soils Mechanics. The section on design and construction has practically all that the average engineer needs to know about the subject. It describes soil exploration, comments on soil pressures and stability of slopes, then devotes many pages to foundations of all kinds on soils of many types.

Most users will need the sections on physical properties of soils and theories on soils only when specifically referred to in the design and construction section.

Great variations in soils and soil conditions limit definite statements or generalities and the authors are chary in definite statements or promises on what soil will do. Not all will agree with the few definite statements that are made. For example, that the bearing power of a friction pile increases about in proportion to its length.

The authors unqualifiedly recommend load tests on all soils, whether for spread footings or piles, as an economy measure. But they also show how some idea of stability of soils can be obtained in the laboratory—*Reviewed by* HAL W. HUNT, *Western Foundation Co., New York.*

Foundation Text

SUBSTRUCTURE ANALYSIS AND DESIGN—By Paul Andersen, 305 pp. Irwin-Farnham Publishing Co., Chicago, Ill. $4.50.

Presenting analysis and design of substructure by conventional methods, this volume is designed as a text, and will also aid designers. Soil mechanics and construction methods are intentionally treated incidentally.

Earth pressure theories, design of sheet piling, cellular cofferdams, spread and mat foundations and pile-cap footings are covered thoroughly, with numerical examples.

Merits of principal pile and hammer types are given briefly. Presentation of pile driving formulas is good. Static friction values and interpretation of load tests are underemphasized. Preservation of piles is given little space.

Designs of wharves, piers, breakwaters and bridge piers and abutments are shown. Treatment of underpinning and open, pneumatic and floating caissons is brief.

In addition to numerous examples worked in the text, unanswered problems are given at chapter ends. A bibliography containing additional references for further study of specific aspects would appear to have been useful.

As intended, conventional methods have been presented. For recent theories such as those of soil classification and action of soils in cellular cofferdams, supplementary sources must be consulted. The volume serves as an introduction to the entire subject of foundaton engineering, and as a detailed text on most of the physical substructures to be built. It contains much well presented information not otherwise conveniently available in one source. Considering the breadth of the field and the limited length of the book, the intended scope appears to have been covered excellently.

For post-graduate study and engineering practice, specialized treatments of soil mechanics, piles and underpinning will be required.—*Reviewed by* ROBERT D. CHELLIS, *Structural Engineer, Boston, Mass.*

Miscellaneous Notes on Booklets and Reprints

A SUGGESTED GUIDE TO BIDDING PROCEDURE has been prepared jointly by the Associated General Contractors of America and the American Institute of Architects. The 7-page pamphlet emphasizes the procedural points from which misunderstandings are most likely to originate. Single copies may be obtained free from the A.G.C., 1227 Munsey Bldg., Washington 4, D. C. The guide also has been published by A.I.A. as AIA Document 333.

New Engineering Books

FUNDAMENTALS OF SOIL MECHANICS—By Donald W. Taylor. 700 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $6.

MODERN OPERATIONAL CALCULUS—By N. W. McLachlan. 218 pp. Cambridge University Press, England; The Macmillan Co., New York. $5.

TABLES OF BESSEL FUNCTIONS OF FRACTIONAL ORDER, Vol. I.—Prepared by National Bureau of Standards. 413 pp. Sold by Columbia University Press, New York. $7.50.

1947 PROCEEDINGS OF THE AMERICAN SOCIETY FOR TESTING MATERIALS, Vol. 47. 1197 pp. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

(*Continued on page* 146)

NORTH • EAST • SOUTH • WEST • • IT'S SCHRAMM!

the Air Compressor You Like to Operate

Compact

. . . no waste space, compressor and engine coupled into a single, rigid, permanently aligned unit . . . balanced to reduce wear and increase efficiency!

Lightweight

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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents
July Materials and Labor Prices will appear in the July 8, 1948 issue

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT* Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash. dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		CONCRETE Ready Mixed 1:2:4 over. 50 c.y. del.
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt.Agg.	
Atlanta	$4.03	$3.26	$2.98	$2.00	$2.00	$1.75	$2.10	$2.10	$1.65	$1.85	$0.1725	$0.1725	$11.00
Baltimore	3.97	3.20	2.92	2.20ff	2.20ff	1.80ff	2.40ff	.....	2.35ff	2.35ff	.15	.15w	9.20
Birmingham	3.65	2.88	.....	2.06	2.06	1.66	2.50	2.50	1.00	1.20	.15	.15	7.45
Boston	4.47	3.70	3.42	1.50‡t	1.50‡t	1.40‡t	1.25‡t	1.35‡t	.....	.....	.186	.195w	10.50m
Chicago	3.65	2.88	2.60	2.75‡d	2.75‡d	3.20‡d	2.75‡d	2.75‡d	2.00‡	2.00‡	.20	.20x	.....
Cincinnati	3.87	3.10	2.82	1.85‡pp	1.85‡pp	1.75‡pp	2.95‡bb	2.95‡bb	2.20	2.20	.19	.195	9.85kk
Cleveland	3.82	3.05	2.72	1.90llq	1.65llq	1.45ll	3.45‡h	3.45‡h	2.60	2.60	.....	.21	11.20ss
Dallas	3.57	2.80	2.52	2.00	2.15	1.75	2.00	2.10	.....	.....	.0775p	.255	8.85
Denver	.....	3.32	3.02	1.85	2.00	1.15	.....	.....	.....	.....	.20	.2175w	9.65
Detroit	3.67	2.90	2.62	3.00‡	3.00‡	2.75‡	2.75‡	2.75‡	2.75‡	2.75‡	.17	.18w	9.15kk
Kansas City	3.68	2.88	2.63	2.05/2.10	2.05/2.10	1.50/1.80t	1.45q	1.45q	.....	.....	.16wf	.175ay	9.85n
Los Angeles	.....	3.60b	3.20b	1.92t	2.02t	1.72tnn	1.92t	1.92t	.....	.....	.085oo	.....	9.96m
Minneapolis	3.95dd	3.18dd	2.90dd	2.10h‡j	2.10h‡j	1.20h‡j	2.20h‡j	2.20h‡j	.....	.....	.19cco	.....	9.65jkk†
Montreal	.....	2.39r	2.24r	1.75bbs	1.75bbs	.....	1.55cs	1.75cs	.....	.....	.1936	.2265w	7.75ls
New Orleans	3.63	2.86	2.58	2.13	2.13	1.82	.....	.....	.90	1.15	.23	.....	10.65
New York	.....	4.00‡	.....	2.00de	2.00de	1.45de	2.00dv	2.00dv	.....	.....	.18ii	.18wccii	10.50k
Philadelphia	3.71‡	2.94‡	2.66‡	2.30‡	2.40‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.22/.25	.22/.25w	9.85
Pittsburgh	3.78	3.01	2.73	2.05‡	2.05‡	2.35‡	2.50‡	2.50‡	2.05	2.05	.22s	.22s	10.85
St. Louis	3.76o	2.99o	2.71o	2.35‡oh	2.35‡oh	2.00/2.35‡oh	1.50c	1.50c	1.10	1.15	.20	.22yo	10.40
San Francisco	.....	3.38	2.98	1.84	1.84	1.94	1.94	.....	.....	.....	.....	.25y	10.75u
Seattle	.....	3.45mm	2.95mm	2.75‡od	2.75‡od	2.75‡od	3.50‡od	3.50‡od	.....	.....	.22o	.....	9.75o

‡ Delivered. *a* F.o.b. truck at plant. *b* 10c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks, Man. *f* F.o.b. truck on job. *g* Pea gravel. *h* Truck Lots. *i* 1½ in. *j* 5% discount for cash. *k* 5 cu. yds. or over, del. Man. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* F.o.b. truck at plant. *r* 10¢ per bbl. off cash 20 days. *s* Sales tax included. *t* Truck delivery. *u* 10 to 100 c.y. brackets. *v* F.o.b. scow, Hudson River, N. Y. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Aver. haul, 7–9 mi. zone. *bb* Under 5 tons. *cc* 8 x 8 x 18 in., also. *dd* Dealers sell only in LCL. This is price for CL and does not include dealer's commission. *ee* 20c refund for each returnable bag. *ff* LCL. *gg* 10c. refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength *jj* 30¢ refund for each returnable bag. *ll* Price at plant, called for. *mm* 10¢ per bbl. off cash 10 days. *nn* Concrete sand *oo* 4x8x12 std. wgt. *pp* 5 tons or more. *Prices include dealer's commission except where indicated to the contrary. †Not including 40¢ heating charge included in price from Nov. 1 to Apr. 15.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL‡‡

Charge for bags not included. For cloth bags, add $1.05 per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 28c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$2.10	$2.10	Ironton, Ohio	$2.15*	$2.15*	Universal, Pa.	$2.20	$2.20
Hannibal, Mo.	2.20	2.20	Northampton, Pa.	2.15	2.15	Waco, Tex. (Plus 9c. tax in Tex.)	1.95	1.95
Independence, Kans.	2.20	2.20	Richard City, Tenn.	2.20	2.20	Montreal City (Discount 10c. per bbl. 20 days)	2.08	2.08
			Steelton, Minn.	2.30	2.30			

* Destination price base effective Dec. 22, 1947

‡‡ Latest data available as this issue goes to press. Cement prices now under study due to Supreme Court decision on multiple basing point pricing system. Any resulting price changes will be reported when available.

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration		CUTBACK ASPHALT Per ton		ROAD OIL Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal.	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	.....	.....	.....	.....	.....	.....	.....	$0.0806	.....
Baltimore	150.00‡	52.70‡	.....	$23.00	.....	$.095	$0.15	$.095h	.....	$.095s	.095	$0.115
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	85.00	59.00	3.75	23.00o	.....	.0936o	.15o	.095ho	.....	.095o	.096o	.185o
Chicago	150.00‡y	85.00/88.00e‡	3.10/4.15d‡	22.50b	$32.00b	21.50bg	31.00bg	.097/.10bh	.....	.082/.0845b	.0925/.1025b	.14/.165b
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	186.52	52.00t	3.87u	28.00	38.00	27.00g	37.00g	.13h	$.21h	.125	.20	.27
Dallas	l	40.00	l	23.38	42.17	.0987	.1837	26.15	46.65	.0962	.1037	....
Denver	.....	41.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	63.00x	.....	27.00	26.00	18.40g	24.40g	.0811h	.128h	.075	.1085	.1522
Kansas City	.....	40.00g	.....	20.45r	.....	.....	.....	.081hr	.....	.07r	.....	.....
Los Angeles	l	.....	l	16.00mf	32.75mf	16.00gm	32.75m	16.50m	33.25m	15.50gm	.0675cc	.1375cc
Minneapolis	.....	.....	2.79d	28.00	37.00	23.00g	34.00g	27.00	38.00	.105	.13	.23
Montreal	125.00	.....	.....	21.60k	31.25k	14.10kp	18.35kp	14.00kp	16.00kp	12.50kj	.153k	.194k
New Orleans	.....	.....	.....	20.00a	.....s	20.00ga	.....s	.095hadd	.....s	.095	.0975	.16n
New York	.....	.....	2.50d	26.50	37.58	25.50g	44.02g	.1086h	.1852h	.1036	.1086	.1909
Philadelphia	150.00	62.00	4.06	23.00	.....	22.00g	.....	.095h	.....	.....	.....	.....
Pittsburgh	165.00	42.00	4.10	26.00	39.00	.12	.24	27.00	42.00	.0925	.10	.21
St. Louis	.....	48.50	.....	16.50/17.50	22.50/23.00	15.50/16.00g	21.50/22.00g	.075/.08h	.165/.17h	.065/.07	.075/.095	.125/.155
San Francisco	.....	57.75c	.....	16.50	33.75w	16.50g	.....	17.50	.....	.....	.0725	.1425
Seattle	.....	.....	.....	16.50i	33.00i	15.00ig	.....	18.00i	22.00aai	16.00ig	.0675i	.0825

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. refinery. *c* 2½ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* 40–80 penetration. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* Shipped in drums, per drum. *k* Tax included. *l* Not used. *m* F.o.b. refinery, El Segundo. *n* 55 gal. drums. *o* Price at plant, in Everett. *p* Per 100 gal. *q* F.o.b. Buffalo. *r* F.o.b. Sugar Creek, Mo. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *u* 3-in. *v* Bulk, refinery. *w* Shipped in double head wood barrels. *x* Truck deliveries in Detroit $75.00 customer's drums. *y* Carload lots. *aa* In *cc* F.o.b. refinery, Inglewood. *dd* Medium curing, rapid curing, $.0975; slow curing, $.0925.

IRON AND STEEL PRODUCTS—PER 100 LBS. BASE MILL PRICES

	STRUCT. SHAPES—PLATE	REINF. BARS billet *be*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Net Ton Standard	STEEL RAILS Per Net Ton Light	STEEL RAILS Per Net Ton Re-rolled	TRACK SUPPLIES Angle Bars	TRACK SUPPLIES Std Plates *c*	TRACK SUPPLIES Tie Plates *c*	TRACK SUPPLIES Track Bolts
Birmingham	$2.75	$2.70	$5.65	..	....	$54.00/55.00	$61.00	Not	$3.75/3.85	$4.85	$3.55/3.65	$7.00
Chicago	2.75	2.70	5.65	....	$3.30	.....	.....	avail-	3.75/3.85	4.85	3.55/3.65	7.00
Pittsburgh	2.75	2.70/2.75	5.65	...	3.30	$54.00/55.00	61.00	able	3.75/3.85	4.85	3.55/3.65	7.00
Buffalo	2.80	2.75	....	....	3.30	.....	.....	....	....	....	3.55/3.65	....
Cleveland	....	....	5.65	.....	.....	.....	.....	....	....	....	....	.....
Youngstown	....	2.70	....	.....	.....	.....	.....	....	....	4.85	....	....
Gary	2.75	2.70	....	....	....	.....	.....	....	....	....	....	....
Geneva	2.75	....	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	3.424/3.474‡*	3.329‡	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *b* Rail steel price upon application. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports. On tie plates alone, Steelton, Pa.; on spikes alone, Lebanon, Pa., Richmond, Va. lengths. Add 50c for cut lengths. *d* Add switching charge $18 per CL. *e* Mill * $3.343 for sizes produced at Geneva.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS *g* Per 100 lb., base price *u* 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH *k* Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x4 in., No. 5 & 10 wires	4x4 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires	SHEET PILING Per 100 lb. base price.
Atlanta	$5.12‡	$5.12‡	$5.12‡	$.025	$.10	$31.00	$33.00	$2.55	$1.76	$2.68	....
Baltimore	4.71	3.97*i*	....	....	.10	33.50	35.50	2.39	1.65	2.50	...
Birmingham	4.25	4.40	4.40	.05	.15	40.00*p*	43.00*p*	2.53	1.74	2.65	....
Boston	5.01‡	4.76‡	4.23‡*c*	....	.10/.15	29.15	31.15	2.47	1.70	2.59	$3.8432*k*
Chicago	4.40	3.50*ff*	3.50*ff*	.05	.05	27.00‡	29.00‡	2.20	1.54	2.31	3.30*x*
Cincinnati	4.82‡	3.883*c*	3.883*c*	....	....	29.00*zee*	31.00*zee*	2.38	1.65	2.49	3.708*d*
Cleveland	4.72	3.50*v**	....	....	.10	29.00	31.00	2.32	1.61	2.44	....
Dallas	6.72	5.00	5.00	....	....	32.50	35.00	2.64	1.81	2.76	....
Denver	5.95	5.80*c*	....	....	....	40.00*s*	45.50*qs*	2.66	1.82	2.79	5.89
Detroit	4.82‡	4.73	....	....	.10	33.50*x*	35.50*q*	2.38	1.65	2.49	3.683*yd*
Kansas City	5.35*ee*	4.23*aak*	4.23*aak*	....	.10	34.00	36.00	2.44	1.69	2.56	3.893*k*
Los Angeles	5.10*fhh*	5.10	....	....	....	40.00*fk*	46.00*fk*	2.74	1.87	2.87	4.78*sd*
Minneapolis	4.81‡	5.179*ccn*	5.179*ccn*	...	.15	30.50*k*	32.50*k*	2.44	1.68	2.55	3.89*k*
Montreal	4.90*i*	4.25*i*	4.25*i*	....	....	40.28*h*	42.98*h*	2.51	1.73	2.63	78.70*ydgg*
New Orleans	....	4.64*ok*	....	.05	.10	27.50	29.50	2.52	1.73	2.64	.....
New York	4.80*r*	4.60	....	....	.15/.20	31.00*st*	33.00*st*	2.42	1.67	2.54	3.35*n*
Philadelphia	4.57	4.59	....	....	....	30.00‡	32.00‡	2.40	1.65	2.51	3.77
Pittsburgh	4.40	4.40	4.40	.05	.10	32.50	34.50	2.20	1.54	2.31	5.05
St. Louis	4.76‡	4.48*c*	4.48*c*	....	....	40.00‡	42.00‡	2.35	1.63	2.46	....
San Francisco	5.00	4.53	....	....	....	32.50	34.50	2.74	1.87	2.87	4.85
Seattle	3.628*e*	4.43*el*	....	....	....	35.00*w*	38.50*w*	2.74	1.87	2.87	4.355*kl*

‡ Delivered. *a* Mill prices. *b* 1-5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. plant *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel. *h* List price. Dominion tax exempt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate and hard grade, new billet. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Del. of 5000 sq. yd. or less. *q* Std. ribbed. 4 lb. per sq. yd. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1¼ in., 1½ in. 10c, ¾ in., ⅞ in. 15c, ⅝ in. 20c, ½ in. 35c, ⅜ in. 55c, ¼ in. $1.30. *v* Under 20 tons. Straight. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* 8.0093 transportation tax included. *z* Copper alloy. *aa* 20 tons base. *cc* F.o.b. cars Chic. plus freight. *dd* F.o.b. dock. *ee* F.o.b. cars. *ff* Carload lots. *gg* Including sales fax. *hh* $4.95 if rolled at Geneva, Utah mills. * Correction; price was $3.50 since Aug. 1947.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13-44T std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM C4-24 Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM C 14-41 12 in.	24 in.	WROUGHT STEEL PIPE** (Full standard weight, f.o.b. destination *s*) 2½ & 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
Atlanta	$92.10	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00	48.2	32.2	42.2	25.7
Baltimore	96.50	.378	.729	3.105	8.098	147.00	228.00	.80	2.20	51.9	35.9	45.9	29.4
Birmingham	85.50	.375	.675	3.06	....	210.00‡	375.00‡	.75	2.00	48.2	32.2	42.2	25.7
Boston	99.90	392*uvx*	.756*uvx*	3.465*uvy*	8.7125**uvy*	150.60	233.40	1.03*yee*	2.75*vee*	50.2	34.2	44.2	27.7
Chicago	98.70	59	1.14	4.81	13.45	150.00‡	270.00‡	.65	2.25	54.0*t*	38.0*t*	47.0*t*	30.5
Cincinnati	97.20	.441	.8505	3.51	9.53	154.80‡	241.20‡	.60	2.25	52.4	36.4	46.4	29.9*t*
Cleveland	99.30	.35*x*	.675*x*	2.97*x*	9.3025*x*	141.50	221.00	.65	2.50	54.7	38.7	48.7	32.2
Dallas	101.08	.375	.675	2.70	6.20	109.00	131.00	.45	1.45	46.3	30.3	40.3	23.8
Denver	105.92	.40*dd*	.71*dd*	2.98*dd*	....	.....	.....	.74*dd*	2.50*dd*	44.4	28.4	38.2	21.7
Detroit	99.30	.63	1.21	4.81	11.20	195.00‡*m*	303.00‡*m*	.55	2.20	52.9	36.9	46.9	30.4
Kansas City	100.42	.39*m*	.705*m*	2.78*m*	7.15*m*	180.00*m*	310.00*m*	.60*l*	1.90*l*	49.7	33.7	43.3	26.8
Los Angeles	112.30	.414	.894	4.347	10.868	220.00‡	360.00‡	.65	...	....	....	....	....
Minneapolis	102.40	.55*mo*	1.05*mo*	4.10*mo*	....	.....	.....	1.19*h*	3.18*h*	49.8	33.8	43.4	26.9
Montreal	78.20	.73*s*	1.28*s*	4.20*z*	6.80*es*	.60*paa*	.48*paa*	72.00*jkaa*	218.00*jkhaa*	....	....	....	....
New Orleans	95.10	.412	.762	3.955	9.15	231.00*bb*	.....	.55	1.95	47.8	31.8	41.8	25.3
New York	95.50	.62	1.14	4.45	12.30	.....	.....	1.00	2.25	51.2	35.2	45.2	28.7
Philadelphia	93.30	.50	.95	3.95	9.75	220.00‡	275.00‡	1.05*h*	2.75*h*	51.7	35.7	45.7	29.2
Pittsburgh	99.82	.364*m*	.702*m*	2.70*m*	6.625*m*	130.20	197.40	1.05*h*	2.50*g*	55.0*t*	38.0*t*	49.0*t*	32.5*t*
St. Louis	96.60	.46	.83	3.30	7.51	.....	.....	1.10*il*	2.30*hl*	51.6	35.6	44.7	28.2
San Francisco	112.30	.438*d*	.878*d*	3.69*d*	9.23*d*	169.00*dl*	282.00*dl*	.69	2.85	....	....	....	....
Seattle	114.10	.45*b*	.81*b*	....	....	150.00*c*	.....	.80	2.40	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, CL, Burlington, N. J. (base) $90.50. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional. 30 in. and larger, usually $1 per ton less. *b* Extra strength ASTM C 200-44T. *c* 4-in., $90. *d* SS361-A. *e* 30 in. *g* Culvert pipe. Reinforced, ASTM C76-41. *h* Reinforced. ASTM C75-41. *i* Reinforced. ASTM C76-37. *j* Centrispun. *k* Per 100 ft. *l* F.o.b. plant. *m* Truck delivery. *o* Listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per ft. *s* Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ¾ in., 8¼c.; ¾ in., 11¼c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. *u* ASTM C13-40. *v* F.o.b. city *x* 2 ft. lengths. *y* 3 ft. lengths. *z* CESA A60-1941 specifications used. *aa* Non-standard specifications in Can. *bb* Freight allowed to destinations in city *cc* Truck loads; f.o.b. plant, Newton. *dd* LCL. delivered. f.o.b. truck **20% emergency freight rate increment granted railroads on Jan. 5 and May 6 freight rate increase (10% in East; 5% on average for U. S.) not included. * Correction: May price was $8.7125.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld —1 in. and 1¼ in. black, 34 galv. 16; 1½ in. black, 38 galv., 18½; 2 in. black, 37½, galv., 18. Lap weld —2½ in. to 3½ in. black, 31½, galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

SHORT LEAF YELLOW PINE AND DOUGLAS FIR

All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)

All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)

		1x6 s4s	1x8 s4s	2x4 s4s	2x6 s4s	2x8 s4s	2x10 s4s	3x12 Rgh	6x12 Rgh	12x12 Rgh
Atlanta	l	**$80.00**	**$82.00**	**$70.00**	**$70.00**	**$75.00**	**$76.00**	**$80.00**	.....	.....
	l	*95.00*	*95.00*	*96.50*	*96.50*	*96.50*	*96.50*	*87.50*	*$87.50*	*$87.50*
Baltimore		**96.00**	**96.00**	**96.00**	**95.00**	**100.00**	**104.00**	**115.00**	.....	.....
		106.00	*108.00*	*112.30*	*112.00*	*114.00*	*114.00*	*121.00*	*121.00*	*121.00*
Birmingham	l	**90.50**	**90.50**	**87.00**	**86.00**	**87.00**	**90.00**	**110.00**	.....	.....
	l	*95.50*	*95.50*	*92.00*	*91.00*	*92.00*	*95.00*	*114.00*	*108.00*	*105.00*
Boston		90.00[3]	90.00[3]	92.00[3]	92.00[3]	92.00[3]	98.00[3]	100.00[3]	.....	.....
		98.00	*98.00*	*98.00*	*98.00*	*98.00*	*98.00*	*105.00*	*105.00*	*105.00*
Chicago	‡	**100.00**	**104.00**	**93.00**	**93.00**	**93.00**	**100.00**	**100.00**	.....	.....
	‡	*108.00*	*108.00*	*100.00*	*100.00*	*100.00*	*105.00*	*105.00*	*105.00*	*105.00*
Cincinnati		**100.00**	**100.00**	**95.00**	**95.00**	**95.00**	**95.00**	**130.00**	.....	.....
Cleveland		**92.95**	**92.95**	**82.89**	**82.89**	**82.89**	**87.94**	.....	.....	.....
Dallas	l	**71.00**	**71.00**	**61.00**	**59.00**	**61.00**	**66.00**	**80.00**	.....	.....
Denver		*101.00*	*100.00*	*97.00*	*94.50*	*94.00*	*95.50*	*97.00*	*104.50*	*103.50*
Detroit		**96.00**	**96.00**	**90.00**	**90.00**	**94.00**	**92.00**	.....	.....	.....
		92.00	*92.00*	*92.00*	*92.00*	*92.00*	.....	.....	.....	.....
Kansas City	b	**110.00**	**110.00**	**100/103**	**100/103**	**105.00**	**105.00**	.....	.....	.....
	b	*110.00*	*110.00*	*100/103*	*100/103*	*105.00*	*105.00*	*110.00*	*135.00*	*135.00*
Los Angeles	a	*103.00*	*103.00*	*103.00*	*103.00*	*103.00*	*103.00*	*107.00*	*117.00*	*107.00*
Minneapolis	‡b	112.00[3]	112.00[3]	.....	.....	.....	.....	.....	.....	.....
	‡b	*108.00*	*108.00*	*108.00*	*108.00*	*108.00*	*110.00*	*130.00*	*130.00*	*130.00*
Montreal	c[2]	73.00	76.00	70.00	72.00	76.00	85.00	.....	.....	.....
		111.55	*111.55*	*111.55*	*111.55*	*111.55*	*111.55*	*120.00*	*87.00*	.....
New Orleans	l	**80.00**	**90.00**	**75.00**	**80.00**	**80.00**	**77.00**	**85.00**	.....	.....
	l	*68.00*	*68.00*	*70.00*	*67.00*	*67.00*	*67.00*	*71.00*	*67.00*	*72.00*
New York	‡	**100/105**	**100/105**	**Range from $90.00 to $95.00**				**110/115**	.....	.....
	‡	.....	.....	*Range from $110.00 to $115.00*				*115/120*	*115/120*	*115/120*
Philadelphia				**Range from $100.00 to $110.00**				**100/110**	.....	.....
				Range from $110.00 to $120.00				*110/120*	*110/120*	*110/120*
Pittsburgh	l	**75.00**	**77.00**	**80.10**	**80.10**	**85.25**	**89.70**	**107.75**	.....	.....
	l	*98.60*	*98.60*	*88.00*	*88.00*	*87.00*	*91.00*	*110.00*	*116.00*	*118.00*
St. Louis	‡j	**110.00**	**110.00**	**110.00**	**107.00**	**110.00**	**113.00**	.....	.....	.....
	‡j	*110.00*	*110.00*	*117.00*	*119.00*	*119.00*	*120.00*	*130.00*	*130.00*	*130.00*
San Francisco	d	*81.00*	*81.00*	*81.00*	*81.00*	*81.00*	*79.00*	*79.00*	*79.00*	*79.00*
Seattle	l	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*75.00i*	.....	.....

LONG LEAF Y. P. Merchantable grade up to 20 ft.

	2x12 Rgh	12x12 Rgh
	.....	.....
	.....	.....
	193.60	182.00
	.....	.....
	120.00	117.50
	.....	...
	.....	.....
	105.00	105.00
	125.00	125.00
	.....	.....
	120.00	.....
	.....	.....
	.....	.....
	72.00	80.00
	.....	.....
	.....	.....
	.....	.....
	.....	.....
	105.00	105.00
	.....	.....
	.....	.....
	.....	.....
	.....	.....
	100.00	105.00
	175/200†	175/200†
	.....	.....
	150.00	150.00
	.....	.....
	130.20	141.00
	.....	.....
	.....	.....
	.....	.....
	.....	.....

PLYWOOD Rail freight increment* (See note for base price)

	5/8"	1/4"
	$22.32	$27.24
	.....	.....
	22.86	27.90
	.....	.....
	21.78	26.58
	.....	.....
	22.86	27.90
	.....	.....
	18.72	22.80
	.....	.....
	21.78	26.58
	22.20	27.12
	18.72	22.80
	13.92	16.98
	21.78	26.58
	.....	.....
	.....	.....
	16.56	20.16
	.....	.....
	13.38g,h	16.26g,h
	16.56	20.16
	.....	.....
	.....	.....
	.....	.....
	18.72	22.80
	.....	.....
	22.86	27.90
	.....	.....
	22.86	27.90
	.....	.....
	22.56	27.48
	.....	.....
	18.72	22.80
	.....	.....
	10.08g	12.30g

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [3] Spruce. [2] Western Pine No. 3 Common. ‡ Delivered. *a* Yard prices. *b* Retail prices, less than CL. *c* 5 M ft. or less. *d* Direct mill prices; f.o.b. purchasers carrier or truck. *e* Tax exempt. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 5000 ft. lots. *k* These are retail yard prices quoted per truck load in Greater Cleveland. Less 2% for cash. Truck lots. *l* F.o.b. mill.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¼", $179.00; on ½", $210.00. For other centers add rail freight increment from table on proper size. For oiling add $3.00; for edge sealing add $2.00; for resin sealing add $8.50.

* Freight rates include 20% emergency increase granted railroads on Jan. 5.

† 18 ft. and under.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS Discounts from jobbers list, Jan. 16, 1946*a* Single or Double Thickness A quality	B quality	EXPLOSIVES Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*
Atlanta	76%	76%	$0.195
Baltimore	70–10%	71–10%	.195
Birmingham	68%	68%	.15
Boston	77%	78%	.195
Chicago	68%	68%	.195
Cincinnati	67–6%*e*	67–6%*e*	.195
Cleveland	67–10–10%	67–10–10–10%	.235
Dallas	65%	65%	.2075
Denver	68%	68%	.20
Detroit	67–10–10%	67–10–10%	.195
Kansas City	68–10%*e*	68–10%*e*	.20
Los Angeles	62%	67%*f*	.2025
Minneapolis	68%	68%	.20
Montreal	40–5%*bc*	40–10–5%*bc*	18.25*h*
New Orleans	68%	68%	.205
New York	73%	74%	.265*g*
Philadelphia	69%	70%	.195
Pittsburgh	70–10%	70–10%	.1675
St. Louis	70–10%	70–10%	.20
San Francisco	66%	73%	.20
Seattle	57%	58%	.2025

Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%

Glass. *a* Jobbers' list price per box, 14 x 20, ss, $20.75 for A quality, $18.00 for B quality; 14 x 20, ds, $30.75 for A quality, $26.00 for B quality. *b* Discount from list, Sept. 1939; sales tax included, but 6% tax exemption not allowable for. *c* Single thickness. *e* Discount from list of Aug. 15, 1938. *f* ss; ds—67%.

Explosives. * Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas. *g* In borough of Kings, Queens, and Richmond and in Manhattan south of Canal St., add delivery charge of $9.00 per trip. *h* F.o.b. city per 100 lb. forcite, 40%, 60%, $20.00.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.155 – 1625	.18 –.1925	.20 –.2125
Rocky Mtn. States	.155 – .1675	.18 –.1975	.20 –.2175
Pacific N. W. States	.1525–.165	.1825–.195	.2025–.215
Pacific S. W. States	.15 –.1575	.18 –.1875	.20 – 21

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail Pine*	By Rail Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in.—2-ft. from butt	6-in	50 to 59-ft.	.35	....
12-in.—2-ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.—2-ft. from butt	6-in.	90 to 100-ft.	....	72
13-in.—3-ft. from butt	5-in.	91 to 100-ft.	....	73
14-in.—2-ft. from butt	6-in.	50 to 69-ft.	.41	80
14-in.—2-ft. from butt	6-in.	70 to 79-ft.	.43	74
14-in.—2-ft. from butt	5-in	80 to 85-ft.	.54	75
14-in.—2-ft. from butt	5-in	85 to 89-ft.	.57	.76
14-in.—2-ft. from butt	5-in.	90 to 100-ft.	....	.80

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.45	.....	$2.00	.....
	Pine	1.35	$3.05*a*	1.90	$4.00*a*
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.50/2.55*a*	....	3.25/3.40*a*
Los Angeles	Douglas Fir	1.86	3.25*a*	....	....
Philadelphia	Red Oak	2.33	3.13*a*	3.10	4.25*a*
St. Louis	White Oak	1.75	....	2.45	....
	Red Oak	1.70	2.35*a*	2.40	3.40*a*
	Sap Pine or Cypress	2.20*a*	....	....	....
San Francisco	Douglas Fir	1.60*ef*	2.80*f*	2.10*bf*	3.88*caf*
Montreal	Birch or Maple	....*h*	....*h*	....*h*	....*h*

Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 7" x 9" x 8'. *c* Empty cell. *e* Green. *f* F.o.b. cars *h* No constant price available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$3.75
Chlorine cylinders, liquid, per lb. f.o.b. works	.07–.12
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, f.o.b. works, ton	22.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.65
Soda ash, 58%, in paper bags, per 100 lb. dense	1.38
Sulphate of aluminum, commercial, in 100-lb. bags f.o.b. works	1.15–1.30
Sulphate of copper, in bags, per 100 lb f.o.b. works	7.60

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity Common backing	Straight hard	LIME Per ton, In paper, Carload lot. Hydrated finishing	Common hydrated	Pulverized, or lump
Atlanta	.....	.....	.....	.....	.....	.....	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	$120.00	$126.00	$220.00	$240.00	$315.00	$340.00	31.00*k*	33.00*k*	30.00	18.00	.....
Birmingham	97.50	104.00	195.00	231.00	.....	.....	20.00*ff*	22.50*gg*	24.67	18.10	.....
Boston	105.00†	112.00†	210.00†	252.09†	.....	.....	20.00*s*	20.00*s*	21.00†	.....	16.00
Chicago	115.00	122.50	230.00	.....	.....	.....	20.00	21.00	25.00	19.50	.....
Cincinnati	155.00*j*	165.00*j*	220.00*jdd*	.....	.....	.....	33.00*j*	33.00*j*	22.00*j*	20.25*j*	.....
Cleveland	113.50*cc*	121.00*cc*	222.50*cc*	.....	.....	.....	27.50	27.50	21.45	19.45	23.55*ee*
Dallas	.....	106.00	.....	.....	.....	.....	18.00	20.00	28.00	22.00	.....
Denver	.....	.....	.....	.....	.....	.....	30.00	30.00	34.80*bb*	28.00*bb*	34.00*bb*
Detroit	130.00	145.00	260.00	300.00	380.00	443.00	28.00*cc*	30.50*cc*	28.00	26.50	26.00
Kansas City	112.00	120.00	.....	.....	.....	.....	16.00*o*	18.50*o*	36.00*p*	30.00*p*	30.00*p*
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	20.00§	.....	.....	36.00	35.00
Minneapolis	148.70*p*	171.55*p*	310.95*p*	171.55*wp*	.....	.....	27.00*rp*	.....	33.50*bbe*	24.50*bbe*	33.50*bbde*
Montreal	100.00*aq*	110.00*aq*	206.25*aq*	151.50*aqq*	.....	294.40*aq*	24.00	34.50	12.50*ub*	14.00*ub*	18.45*u*
New Orleans	160.00	160.00	300.00	.....	.....	.....	29.00	.....	30.00	20.00	.....
New York	112.20*h*	119.60*h*	164.50*h*	179.40*hn*	.....	.....	30.50	.....	34.00	25.90	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	26.00	29.00	29.75	17.50	24.50
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	26.00	31.00*y*	20.45	18.65	2.97*m*
St. Louis	118.50	122.00	225.00	235.00	305.00	.....	28.50*al*	26.50*al*	.72*aap*	.55*aap*	.82*aaspee*
San Francisco	124.00*a*	139.50*a*	186.00*dda*	139.50*ta*	.....	.....	27.50	.....	24.85	24.85	2.48*m*
Seattle	137.00*cc*	147.00*cc*	.....	147.00*ccw*	.....	.....	32.00	39.00	32.00*hhh*	32.00*hhh*	3.60*mhh*

† F.o.b. *a* Smooth. *b* Per 50 lb. bags. *c* 6 x 12 x 12 in.-3 cell. *d* Pulverized hot. *e* 5% discount for cash. *g* 5½ x 8 x 12. *h* F.o.b. trucks, job site N.Y.C. *i* F.o.b. warehouse only. *j* Truck load or over. *k* $1.00 discount. *l* Red face. *m* Per bbl., 180 lb. *n* 7½ x 7½ x 12. Speed tile. *o* F.o.b. Buffalo. *p* Truck lots. *q* Provincial and Municipal tax extra. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* Tax exempt. *v* Sand lime. *w* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime not sold per ton. *bb* LCL. *cc* Truck delivery. *dd* 6 x 12 x 12. *ee* Pebble lime. *ff* 80% common. *gg* Select. *hh* LCL. § F.o.b. plant.

PAINT, ROOFING — F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in 100 lb. cases In oil *w*	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$21.60	$29.875	$1.75	$2.70	$1.65	$2.06‡	$2.06‡	$2.06‡	$1.00‡	$36.00‡
Baltimore	21.35	29.50	2.25	3.50	2.75	2.75	3.30	3.30	.55	33.00
Birmingham	21.60	29.875	4.40	4.52	....	3.05	3.00	3.00	.48	42.00*ee*
Boston	21.35	29.50	1.75	2.50	2.31	2.00‡*h*	3.30‡*q*	3.30‡*q*	.25‡	21.00
Chicago	21.35	29.50	....	....	....	2.78‡*u*	2.91‡*o*	2.91‡*o*	34.00‡*bb*	35.00‡
Cincinnati	21.35	29.50	....	....	....	2.39‡	2.50‡	2.50‡	.35*y*‡	40.00‡
Cleveland	21.35	29.50	3.00	3.00*s*	3.00	2.39	2.50*o*	2.50*o*	.32*y*	35.40
Dallas	21.35	29.50	....	4.05	....	2.69*q*	3.00*q*	3.15*q*	.90	45.00
Denver	21.35	30.00	2.88	4.38	2.63	3.17*o*	3.10*o*	.....	.46*ff*	44.00
Detroit	21.35	29.50	2.40	3.20	2.20	2.39	2.50	2.55	.50	33.00
Kansas City	21.35	29.625	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.50	.54	31.00
Los Angeles	21.60	30.00	2.80	4.00	3.50	2.32	1.77*e*	*l*	.65	*l*
Minneapolis	21.35	29.125*m*	....	....	....	2.27*idd*	2.38*hidd*	2.38*hidd*	.42*idd*	33.00*rdd*
Montreal	.....	19.20	2.90*p*	4.20*p*	3.62*p*	3.14*t*	2.85*tf*	2.30*tf*	.68*t*	2.15*kt*
New York	21.35	29.50	3.45*y*	....	3.45*y*	2.28	2.3*so*	2.38*o*	.34*s*	33.00
Philadelphia	21.35	29.50	3.25	3.65	3.15	2.54	2.94	2.94	.37	26.00
Pittsburgh	21.35	29.50	2.00	2.90	1.90	2.93	3.00*o*	3.00*o*	.37	38.00
St. Louis	21.35	29.50	....	....	....	2.78	2.70	2.70	.48	36.00
San Francisco	21.60	29.75	1.80	2.75*n*	1.35	2.27*z*	3.30*aa*	....	.38*g*	.....
Seattle	21.60	30.00	2.95*m*	2.95*m*	....	3.25*mqcc*	3.35*hmcc*	....	.49*mcc*	46.75*jmcc*

‡ Delivered Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* 15 lb. *f* Per 432 sq. ft. *g* 50 gal. drums. *h* Per roll. 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *l* Not used. *m* 1% discount for cash. *n* May, 1941 price. *o* Per 60-lb. roll. *p* Tax included. *q* Per 90-lb. roll. *r* F.o.b. factory Chicago. *s* ASTM Spec. D266-41. *t* Federal tax included. *u* Per 90 lb. square. *v* Per ton. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container. *z* Drums. *aa* Approximate cost per 100 lbs. *bb* Roofers coating and cement. Price per ton. *cc* LCL. truck delivery. *dd* 2% cash discount. *ee* Asphalt in 100 lb. package. *ff* 5-gal. drums.

SKILLED AND COMMON WAGE RATES — PER HOUR

	brick-layers	Car-penters	Struct. Iron Workers	Hoisting Engineers	Plas-terers	Electrical Workers	Steam-fitters	Common Labor Building	Common Labor Heavy Const.
Atlanta	$2.25	$1.65	$2.00	$2.00	$2.00	$2.00	$2.00	$0.75	$0.85
Baltimore	2.50	1.95	2.40	2.20/2.40	2.00	2.25	2.25	1.10	1.10
Birmingham	2.25	1.80	2.15	1.75/2.00	2.20	2.00	2.25	.95	1.05
Boston	2.50	2.10	2.40	2.25	2.50	2.30	2.30	1.55	1.55
Chicago	2.40	2.35	2.40	2.35	2.40	2.35	2.35	1.70	1.70
Cincinnati	2.25	1.975	2.10	2.00	2.125	2.125	2.125	1.25	1.15
Cleveland	2.375	2.325	2.375	2.25	2.375	2.375	2.375	1.725	1.40
Dallas	2.25	1.875	2.00	2.00	2.125	2.00	2.125	.95	.95/1.50
Denver	2.25*b*	2.10	2.00*b*	2.15*b*	2.25	2.25	2.24	1.40	1.35
Detroit	2.25	2.20	2.40	2.40	2.40	2.40	2.40	1.575‡	1.575‡
Kansas City	2.50	2.05	2.20	2.05/2.75	2.50	2.15	2.125	1.475	1.40
Los Angeles	2.375	1.90	2.10	1.85	2.25	2.25	2.25	1.35	1.35
Minneapolis	2.25	1.80	2.00	1.85	2.25	2.21	2.00	1.45	1.45
New Orleans	2.05	1.70	2.00	1.625/1.875	1.875	2.00	2.05	.90	.90
New York	2.75*b*	2.75*b*	3.00	3.00	3.00*a*	2.50*a*	2.75*b*	1.70	1.70
Philadelphia	2.75	2.25	2.65	2.50	2.50	2.375	2.50	1.25	1.25
Pittsburgh	2.50	2.25	2.25	2.40	2.25	2.25	2.25	1.30	1.30
St. Louis	2.50	2.45	2.425	2.55	2.25	2.25	2.25	1.50	1.75
San Francisco	2.8125	2.00	2.25	2.00	2.25	2.25	2.25	1.40	1.40
Seattle	2.365	2.065	2.265	2.20	2.365	2.265	2.34	1.665	1.70
Montreal*	1.40	1.06	1.11	1.00	1.17	1.11	1.11	.73	.67

a 6 hr. day. *b* 7 hr. day. * Cost of living bonus now included in basic wage. ‡ May rate, $1.575.

MEXICO CITY PRICES

In Pesos, F.o.b. City		Apr. '48	May '48
Common Wages—Building (8 hr. day)	av. per hr.	.57	.57
Common Wages—Heavy Const. (8 hr. day)	av. per hr.	.75	.75
Skilled Labor Wages			
Carpenters (8 hr. day)	av. per hr.	1.25	1.25
Bricklayers (8 hr. day)	av. per hr.	1.25	1.25
Struct. Iron Workers (8 hr. day)	av. per hr.	1.50	1.50
Struct. Steel Shapes			
3"-15" x 12 meters	per ton	800.00	800.00
Reinf. Steel, Corr. Rods			
⅜" x 12 meters	per ton	950.00	950.00
½" x 12 meters	per ton	950.00	950.00
⅝" x 12 meters	per ton	940.00	940.00
¾" x 12 meters	per ton	940.00	940.00
⅞" x 12 meters	per ton	930.00	930.00
1" x 12 meters	per ton	925.00	925.00
Gravel, truck load of 3½ cu. meters			
Blue Gravel	per tr. load	30.00	30.00
Rose Gravel	per tr. load	28.00	28.00
Cement, Std. Port. (Tolteca)	per ton	115.00	115.00
Lumber			
Mex. Sacred Fir (Oyamel)	per M ft.	360.00	360.00
1st Class Pine	per M ft.	750.00	750.00
2nd Class Pine	per M ft.	600.00	600.00

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $2.250. **ENR Common Average:** $1.352

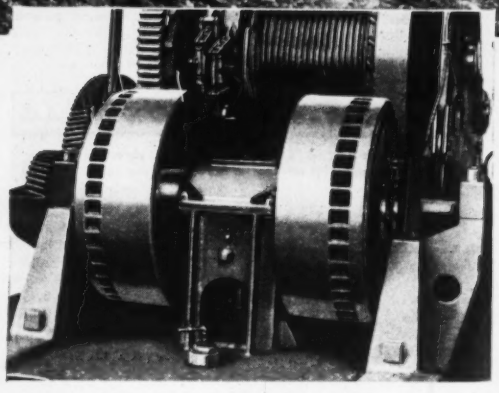
SWING FRICTIONS ARE *OUT*

THE MAGNETORQUE'S *IN*

P&H 1055 owned by Lytle-Amis-Green at Potholes Dam, Columbia River Irrigation Project. Nine million yards of rock and dirt will make this the 4th longest dam in the U. S.

It's the downright simplicity of the P&H Magnetorque that makes such a big difference in overall operation. It makes swing frictions obsolete — puts an end to high maintenance costs — eliminates routine adjustments that normally rob machines of productive time.

The Magnetorque handles all swing motions electro-magnetically — yet without big motors or tricky, complex electrical equipment. It's simple, dependable, trouble free. And it's smooth — with fast, velvety starts and stops. No jolting and jarring to strain the swing assembly or other parts of the machine. Ask us to tell you where you can see one at work.



THE P&H MAGNETORQUE UNIT transmits power for swing electromagnetically without mechanical contact between driving and driven members—without friction, without wear. It lasts the life of the machine.

P&H

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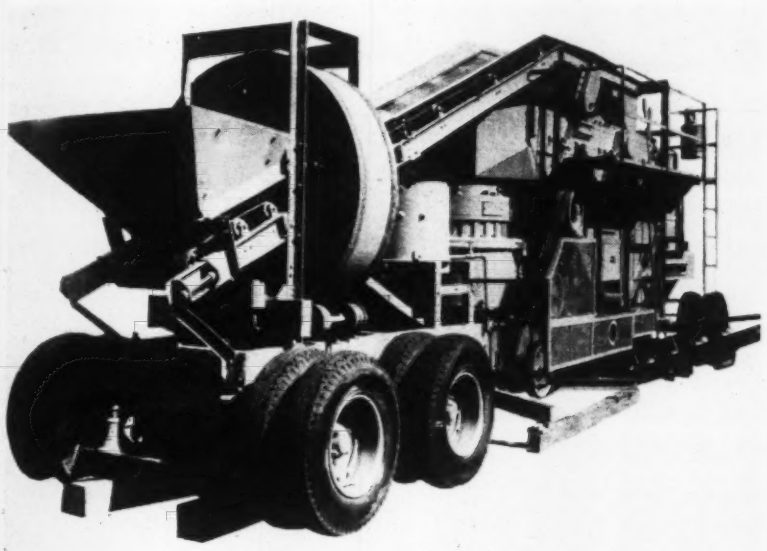
New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

(Number refers to item directly below it)

396



CRUSHING AND SCREENING PLANT—A new portable crushing and screening plant in which the crushing is handled by a cone crusher has just been announced. It is used for secondary crushing of rock or gravel where the material being fed is fairly uniform in size and requires a reduction of only one or two sizes, and where fines are not particularly desired. It is frequently used in a unitized plant set-up where the primary crushing is handled by a portable primary or a scalping unit. This new plant consists of a 22-in. Symons pedestal-type cone crusher, 42 in. x 10 ft. double-deck horizontal vibrating screen, and the necessary conveyors, chutes, drives, and hoppers for different kinds of work. The truck is offered with a choice of steel wheels or pneumatic tires.—*Iowa Mfg. Co., Cedar Rapids, Iowa.*

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CABLE-CONTROLLED TRACTOR EQUIPMENT—Complete line of cable-controlled equipment, for use with new International TD-24 crawler tractor includes bullgrader, bulldozer, scraper and ripper. High-test steel castings are used in combination with weldments. Cable and sheaves are protected by steel guard. Cable reeving is uncomplicated and large sheaves are mounted on roller bearings and placed well out of the way of dirt. Full operating visibility is claimed as feature of bullgrader and bulldozer. Scraper has struck capacity of 22 cu.yd. Low center of gravity of scraper makes for speed and stability in field operation. Scraper apron can be easily converted from conventional solid type to hinged type for fast ejection of stickiest materials. Double-curve cutting edge "boils" earth upward into apron and bowl with minimum compacting. Front-mounted hoist tackle and wide-spread rear wheels insure maximum stability. New heavy-duty ripper has detachable alloy steel standards angled for natural digging action. Power for new TD-24 tractor equipment is controlled by either a front-mounted or a rear-mounted power control winch, either a single or a double drum unit with planetary drive to eliminate need for frequent adjustments.—*Bucyrus-Erie Co., South Milwaukee, Wis.*

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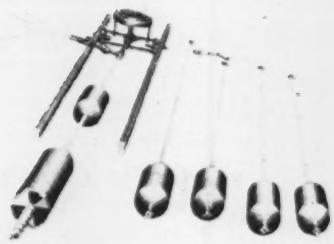

LATERAL EARTH DRILL—Accurate boring alignment for holes up to 100 ft. in length is claimed for the Detrick Lateral Earth Drill, a rig whose use eliminates open trench excavation for laying short runs of pipe. The device consists of a track frame, a power transfer gear box, hollow sectional torque rods with 8-in. guide cylinders and a driller head. The gear box

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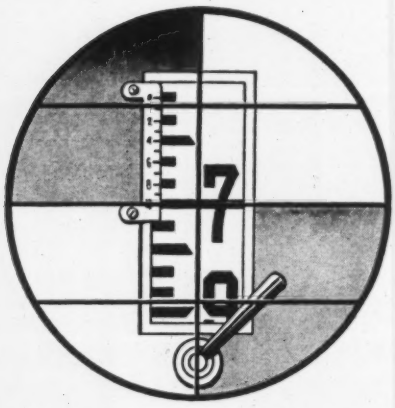

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Illustrated, famous Type II Transit No. 7016. Telescope 11½" long — internal focusing — 24 power. Horizontal limb graduated to 15 minutes, Verniers to 20 seconds, 6½" diam.

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Manufacturers of
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takes power from an electric drill or from a hand crank and translates the power into drilling torque and lateral motion. This drill assembly also has a connection which permits the flow of water through the torque rods to the drilling head. The drilling head consists of a 2-in. earth augur, an 8-in. three-vane post-hole type digger and an 8-in. guide cylinder. In operation, the track-frame is anchored astride the pipe centerline and parallel to the line. The power assembly is fixed on the frame. A torque rod is inserted in the power assembly, in the position which places the drilling head at the face of the cut. Drilling proceeds until the limit of the first torque rod is reached, then a second rod section is inserted and the process is repeated. In tests, an 8-in. hole was driven electrically through clay a distance of 40 ft. in 4 hours. This job was done from a 15-ft. long trench. The standard 8-in. holes may be enlarged by use of a reamer. Pipes are jacked through the holes.—*Detrick Lateral Earth Drill, 14th at Maple, Quincy, Ill.*

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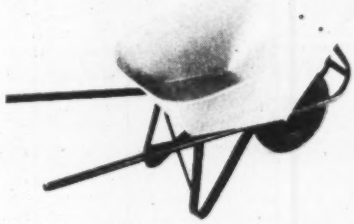

RUBBER-TIRED WHEELBARROW —A 5-cu.ft. spot welded aluminum body on this rubber-tired wheelbarrow reduces worker fatigue by cutting load. Carriage, legs and wheel are of steel and tire is puncture proof.—*Lacar Enterprises, P. O. Box 234, Belmont, Calif.*

400

CONCRETE PAVING FINISHER— Independent control of traction and screeds is provided by new automotive type transmission. Selective control provides operator with sixteen combinations of screed and traction speeds, claimed to be an advantage in finishing air-entrained concrete. Equipped with 27-hp. engine and with vibratory paving attachment. There is a quick adjustment for crown and the screeds have a telescopic width adjustment. End trucks of unit type are moved over on main structural members for width changes. V-Belt drive with automatic take-up absorbs shock of starting and stopping. Machine has hydraulic screed lifting system.— *Blaw-Knox Co., Pittsburgh, Pa.*

401

SELF-LOCKING PLIER—This plier locks by normal hand pressure instantly and without adjustment. Power made possible by a special cam action gives the plier great cutting pressure. It is made of drop-forged chrome vanadium steel with hardness rated at Rockwell RC 52-54. It will cut 19-strand No. 1 electric cable, 30-penny spikes and ¼-in. bolt stock or rod.—*Ross Mfg. Co., 300 Montgomery St., San Francisco 4, Calif.*

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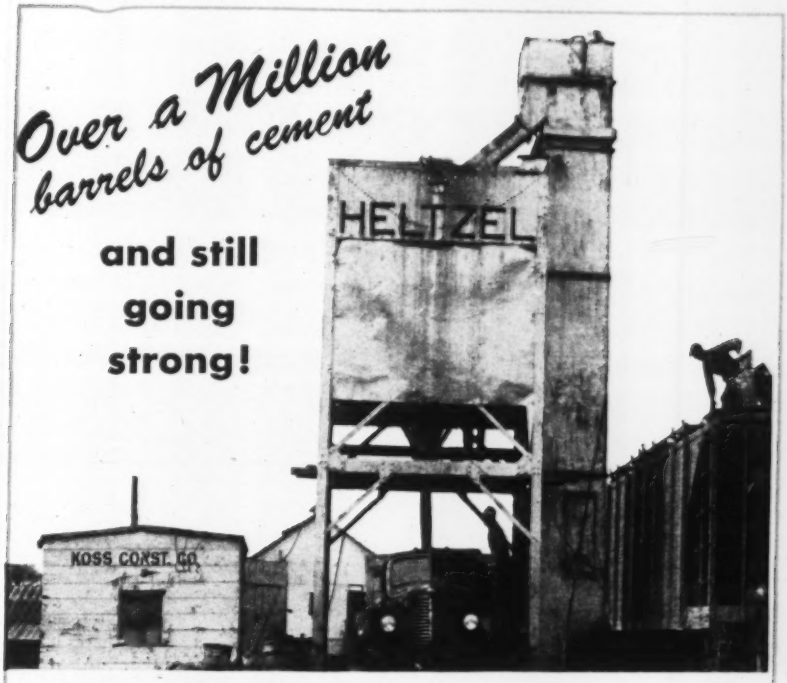
MOBILE TOWER-CRANE — Addition of crane boom to chassis enables contractor to perform other operations with same piece of mobile equipment. Tower can be driven to job and erected in 10 or 15 minutes to hoist concrete or building materials. In addition to this operation there is now available a 20-ft. boom with a lifting capacity of 9000 lb. on a line 7 ft. to the rear of the truck chassis. Tower can be completely removed from chassis and set to one



VETERAN HELTZEL PLANT HAS REPAID ITS COST 42 TIMES OVER IN 17 YEARS . . .

• 1,160,500 barrels of cement have been unloaded by this plant. In 1931, time studies indicated the plant cost would be repaid at the handling of 25,000 to 30,000 barrels. (Note comments by Mr. Koss in the following letter.)

KOSS CONSTRUCTION CO.

April 21, 1948

DES MOINES, IOWA

Mr. Donald T. Heltzel
Heltzel Steel Form and Iron Co.
Warren, Ohio

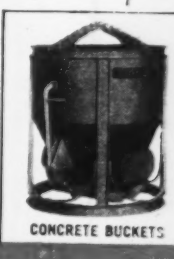
Dear Sir:

Our records indicate this bin was purchased by us in 1931. It has been used by us on paving projects all over the middle-west from that time until the present and is still a good plant and doing a fine job. During this period, we have unloaded 1,160,500 barrels of cement with the Heltzel, including box cars, hopper bottoms and truck delivery. You can be justifiably proud of the performance of this equipment.

Yours very truly,

RBK:m

Richard B. Koss
Vice President



CONCRETE BUCKETS

Heltzel plants are products of specialized engineering, and constructed for lasting, trouble-free service. Your requirements for plants will be served best by Heltzel. Write for information and literature.

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO · U. S. A.

GREATER YARDAGE!
LOWER COST!

WELLMAN *Williams*
WELDED BUCKETS

Wellman Buckets cost less to maintain because they are ruggedly built. They deliver bigger payloads because they are properly designed. The superior engineering in Wellman Buckets gives the operator better balance, easier handling, cleaner digging. Wellman pioneered the unique construction that pays off in greater yardage at lower costs. There's a Wellman Bucket for every service.

SEND FOR BULLETIN

THE WELLMAN ENGINEERING COMPANY
7000 CENTRAL AVENUE CLEVELAND 4, OHIO

PHILIPS AND DAVIES, INC.
KENTON, OHIO

Designers and Builders of High Head Sluice Gates, Hoists, Cranes and Allied Equipment For Dams.

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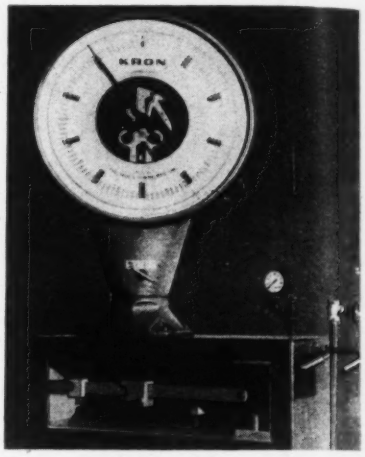
side by machine's own boom. The 20-ft. crane boom can be increased in length in increments of 10 ft. up to a maximum of 40 ft. Boom swing is 360 deg. and elevation is 85 deg. Standard tower section is 35 ft. high with one 10-ft. extension to give a maximum hoisting height of 45 ft. Lifting capacity of tower section is 6000 lb. Accessories available with hoisting tower are a 1½-cu.yd. concrete hopper and a 6 x 6-ft. materials platform.—*Mixermobile Manufacturers, Portland, Ore.*

403



WEIGHT BATCHER DIAL SCALE—Manufacturer of concrete batching equipment has introduced a dial scale as optional equipment on Noble weigh batchers. This scale is available in manual and semi-automatic models. On the latter, weight of cement required is set on a poise beam, and the cut-off at final weight is controlled by the Noble photo relay system of weight control. Dial indicator is at zero position when cement weight is completed. Aggregate weight is cumulative dial reading from there on. The Noble back balance multiple beam scale is standard equipment on manual and semi-automatic batchers and is recommended for use where accuracy is of utmost importance.—*Noble Co., 1860 7th St., Oakland 7, Calif.*

404

CURING BLANKET SPLICER—Machine pays out "Scotch" Wetordry tape as fast as man can walk, joining sheets of asphalt-impregnated paper into a single protective covering for curing fresh concrete. Tape sticks on contact as machine, weighing 33 lb., presses it tightly in place. When concrete has cured, tape can be stripped off easily permitting full width of protective paper to be reused repeatedly. Protective paper slows evaporation of water in concrete.—*Minnesota Mining & Mfg. Co., 900 Fauquier Ave., St. Paul 6, Minn.*

SPEEDS UP and Siding

NELSON STUD WELDING, DIVISION OF MORTON GREGORY CORPORATION
2715 Toledo Avenue, Lorain, Ohio

Please send immediately special folders illustrating use of Nelson Method of Welded Stud Fastening for the following materials:

- ☐ Corrugated sheet metal roofing
- ☐ Corrugated sheet metal siding
- ☐ Corrugated protected metal roofing and siding
- ☐ Sprinkler and piping systems
- ☐ Conduit and wireways
- ☐ Installation of the non-combustible compressible and rigid types.

Name of Company .....

Street .....

City ..... *State* .....

Nelson Stud Welding Method Also Reduces Cost of Installing or Applying Insulation, Wireways, Pipehangers, Sprinkler Systems

"When you can keep the whole crew *on top of the roof* you not only get the job done faster, but you knock out a big item of hidden cost."

This is the way Roofing Contractors in all parts of the country are explaining the amazing cost reductions obtained by using the Nelson "Rivweld" method of fastening corrugated sheet metal and protected metal roofing and siding.

Because all work is done from the top side of the roof,

No inside scaffolding or rigging is required
No workmen are needed under the roof

The accident hazard is greatly reduced in addition to reducing the time required for actually applying the roofing material.

In this simplified method, a Nelson Stud Welding Gun (a lightweight, portable "tool of the trade") is employed to electrically weld special *Nelson "Rivweld" Rivet Studs* to the purlins. The "production line" operations involved in this simplified method are illustrated and explained on the opposite page.

The Nelson Method of Welded Stud Fastening is also being utilized in a similar manner for applying corrugated sheet metal siding; corrugated protected metal roofing and siding; for installing sprinkler and piping systems; conduit and wireways; metal lath and insulation of the non-combustible compressible and rigid types; as well as structural insulating board and similar types of materials. Write for illustrated folders explaining how the *Nelson Method of Welded Stud Fastening* reduces costs in applying a wide variety of materials. Wire or 'phone direct to factory if you need this equipment on a job that is coming up immediately.

NELSON Stud Welding
Division of Morton Gregory Corporation
2715 TOLEDO AVE. • LORAIN, OHIO

Actual Full Size Sample Available . . . Use Coupon

TRADEMARK

NELSON METHOD of WELDED STUD FASTENING

MASTER COST-SAVING EQUIPMENT—FOR IMMEDIATE DELIVERY

Gas or Electric Concrete Vibrators (Catalog No. 689)

Hand Tools for operating from all Master Vibrators and BIG-3 (Catalog No. 683)

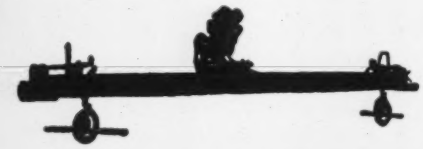
BIG-3 for Generation, Tool Operation and Concrete Vibration (Catalog No. 687)

Portable Gas-Electric Generator Plants. Sizes 500 to 17000 Watts (Catalog No. 594)

General Purpose Floodlights

"Power-Blow" Electric Hammer and Spade (Catalog No. 688)

Gas or Electric Back-Fill Tampers (Catalog No. 699)



Vibratory Concrete Finishing Screed. Sizes 6' to 36' (Catalog No. 596)

"Turn-A-Trowel" for trowelling concrete Sizes 48" or 34" (Catalog No. 685)

Send for illustrated catalog on any item to

MASTER VIBRATOR COMPANY

DAYTON 1, OHIO

MORE YARDAGE LESS LABOR LARGER PROFITS

When You Use a SAUERMAN SLACKLINE CABLEWAY

Sauerman Slackline Cableway pictured above digs gravel from lake and keeps screening plant supplied with 75 cu. yd. an hour at cost of only a few cents per yard. For digging deep and conveying to elevated delivery point there is no machine quite equal to a Sauerman Slackline Cableway.

For the most difficult digging jobs in ponds, rivers, deep pits, etc. and for conveying to elevated bin or pile, Sauerman Slackline Cableways are the fastest, lowest cost, most efficient equipment. Continuous operation under one-man control. Many of these machines now in operation have 20 to 25 years of service behind them, with only minor maintenance care and a general overhaul every five years or so.

May we send complete information?

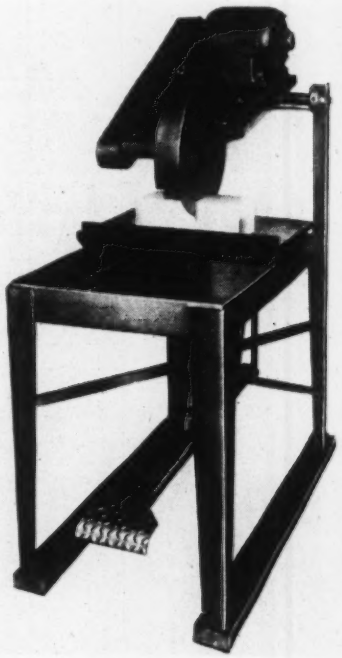
★

SAUERMAN BROS., Inc.

532 S. Clinton St. Chicago 7, Ill.

mixer into trucks or for stockpiling. Discharge height is from 7¾ to 8¾ ft. Operated by hoist powered by mixer motor. Loader is fully controlled by single lever on operator's platform.—*Koehring Co., 3026 W. Concordia Ave., Milwaukee 10, Wis.*

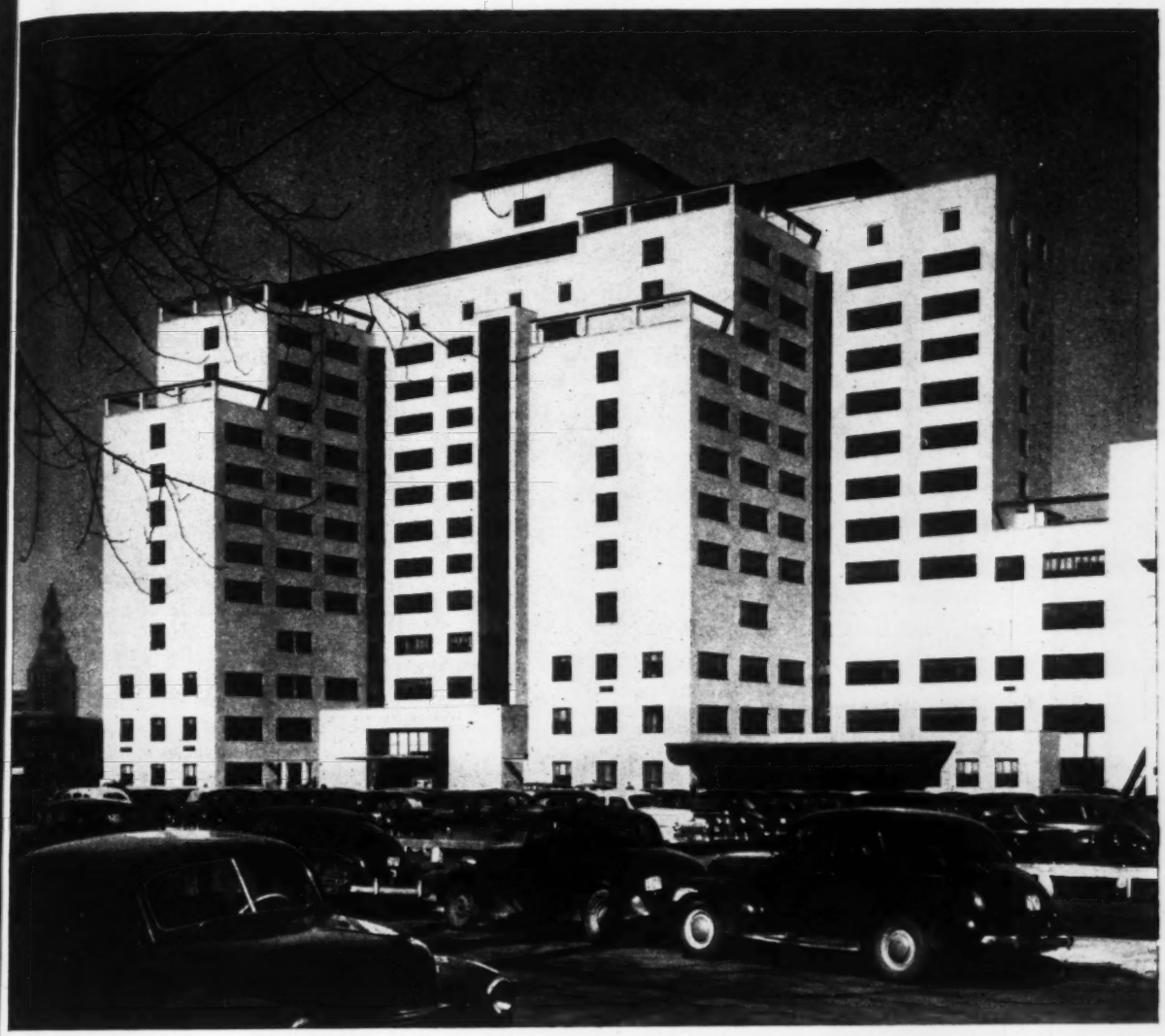
406



MASONRY SAW—This new model masonry cutting saw is designed for fast and accurate cutting of all types of masonry and ceramic materials. It cuts either wet or dry. A 1½-hp. enclosed, ball-bearing motor supplies adequate power. Either abrasive masonry cutting blades or diamond blades can be used. This model has a self-priming centrifugal pump with a self-contained water system.—*Champion Mfg. Co., 2028 Washington Ave., St. Louis 3, Mo.*

407

LOW-COST STONE CRUSHER—An experimental model of a super-size double impeller impact breaker has been constructed. The manufacturer expects that the machine will handle any stone fitting into a 2-yd. shovel. It is designed to produce aggregate in minus 8 in. and minus 3½ in. Two impellers which strike the stone in midair as it falls into the breaking chamber will each weigh 13,400 lb., with bars. Each impeller will have three pairs of 500-lb. bars. Rotating in opposite directions, the impellers will be capable of a maximum speed of 785 rpm. It is estimated that each impeller will require a separate power unit of from 100 h. p. up—*Downs Crane and Hoist New Holland, Pa.*



Architects: Coolidge, Shepley, Bulfinch and Abbott, Boston. *General Contractor:* George A. Fuller Co., Boston. *Steel Fabricator:* Utica Structural Steel Co., Utica, N. Y.

Addition to Hartford Hospital

Eye-appealing in its facing of white, semi-glazed brick, this new hospital at Hartford, Conn., is to be known as Hartford Hospital High Building. It is 15 stories in height and will provide 750 beds. Like many other attractive buildings now under construction throughout the country, it embodies a framework of Bethlehem Structural Shapes.

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STRUCTURAL SHAPES

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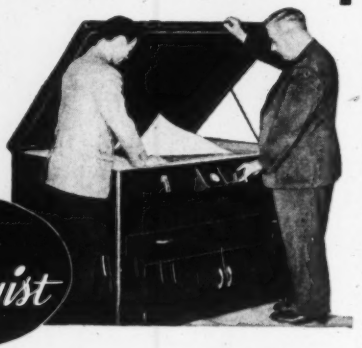

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125 Hunter Avenue, Syracuse, N. Y.

Manufacturers' Publications

408

Pipe Threader—(4-p. bulletin). Deals with adjustable pipe threader designed for power drive use. With capacity from ½ to 2 in., the machine uses full width heavy-duty high speed steel dies, fully adjustable to cut standard, over-size or under-size threads to compensate for variation in pipe fittings. Three different types of knives for cutting off pipe and beveling pipe for welding.—*Beaver Pipe Tools, Inc., Lauren, Ohio.*

409

Shovel Yardage Estimator—Cardboard devices in slide rule form facilitates quick determination of estimated yardage per hour for various sizes of dragline and shovel digging in materials under different conditions. Estimating device is 9 in. long and $3^{3}/_{4}$ in. wide. Figures are general estimate only and should not be considered as guaranteed outputs for figuring and bidding jobs. Tables and data are given to make necessary corrections and conversions for different sizes of machines and varied digging conditions.—*Thew Shovel Co., 1404 Terminal Tower, Cleveland, Ohio.*

410

Paint Brushes—(14-p. booklet). Tells how to save money on the job with paint brushes bristled with Du Pont Nylon. Covers development of nylon bristles, gives instructions as to use and care of brushes and describes recommended procedures for cleaning and reclaiming. Also factual data on brush performance and pointers for painting economies.—*Plastics Department, E. I. du Pont de Nemours & Co. Inc., 629 Schuyler Ave., Arlington, N. J.*

411

Portable Gravel Plant Drives—(8-p. pamphlet). Explains how portable gravel plant for crushing and spraying is powered by diesel-electric drives emphasizing reduction in weight and savings in mechanical maintenance costs accomplished by electric drive. Explains how simplified drives are arranged and gives specifications.—*Pioneer Engineering Works, Inc., Minneapolis 13, Minn.*

412

Portable Gasoline Hammer—(12-p. booklet). Covers Barco hammer powered by air-cooled two-cycle single-

MONEY! (an ad about money)
by Mr. Friendly

care of medical expenses and first aid in the shortest time!

"It all adds up," he smiled, "to more money, for you . . . this alone should be of interest . . . but even more, we offer free of charge, as a demonstration of one type of assistance we include in our service, two illustrated text books: 'Surface Construction Without Accidents' and 'Foremanship and Accident Prevention in Construction' . . . Send for them today. And, by all means, mail this valuable coupon without delay.

"See you shortly!"

A M

Your helping hand when trouble comes!

MAIL THIS COUPON NOW — WITHOUT DELAY!

Dept. 0-65, American Mutual Liability Insurance Co.
142 Berkeley St., Boston 16, Mass.

Without obligation, please *rush* to me more information on the All-American Plan, so that I may be richer and happier!

*Name*_____

*Street*_____

*City*_____ *State*_____

Worthington-Ransome Blue Brute Distributors

See ad on page 137 for list of equipment in each line

Worthington-Ransome Distributors

Ala., Birmingham, Ragsdale Mach. Co., Inc
Alaska, Anchorage, Airport Mach. & Storage Co
Ariz., Phoenix, Lee Redman Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son

Calif., Richmond, Bay Equip. Co.
Cal., L. A. Golden State Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., Wallingford, Wilhelm-Davies Co., Inc.

Fla., Miami, Allied Equip. Inc.
Jacksonville, Ogden Equip. Co.
Orlando, Highway Equipment and Supply Co
Tampa, Epperson & Company

Ga., Atlanta, Tractor & Machinery Company

Ida., Boise, Olson Manufacturing Co.
Ill., Chicago, Thomas Hoist Co.
Iowa, Cedar Rapids, McNall Mach. & Supply Corp

Kansas, Topeka, M. B. Salisbury Co.
Ky., Harlan, Croushorn Equip. & Supply Co.
Louisville, Williams Tractor Co.

Maine, South Portland, N. A. Burkitt, Inc.
Mich., Muskegon, Lakeshore Machy. & Supply Co. Inc.
Mich., Detroit, W. H. Anderson Co., Inc.
Minn., Minneapolis, Phillippi Murphy Equip. Co.
Mass., Cambridge, Field Machy. Co.
Mass., West Springfield, E. F. Edson Co., Inc.
Miss., Jackson, Jackson Road Equip. Co.
Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co., Inc.
Montana, Billings, Seitz Machinery Co., Inc.
Helena, Caird Eng. Works
Montana, Missoula, Miller Machinery Co.

Nevada, Elko, C. W. Paul Hardware and Machy. Co
N. Hampshire, Manchester, R. C. Haselton Co., Inc.
N. J., No. Bergen, American Air Comp. Corp.
N. M., Roswell, Smith Machy. Co.
N. Y., Buffalo, Murray Equip. Co.
New York, Hodge & Hammond, Inc.
N. C., High Point, Smith Equip. Co.
N. D., Fargo, Smith, Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll-Edwards & Co.
Toledo, The Kilcorse Machy. Co.
Okla., Oklahoma City, Tattan-Douglas Equip. Co.
Oregon, Portland, Andersen Machinery

Pa., Bradford, Bradford Supply Co.
Wilkes-Barre, Ensminger & Co.
Mechanicsburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Memphis, Hamilton Tractor Co.
Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co.
Abilene, W. T. McClure Mach. Co.
Dallas, Shaw Equip. Co.
Houston, So. Texas Equip. Co., Inc.
San Antonio, San Antonio Machy. & Supply Co.

Utah, Salt Lake City, J. K. Wheeler Mach. Co.

Vt., Barre, A. M. Flanders, Inc.
Va., Richmond, Highway Machy. and Supply Co.

W. Va., South Charleston, Allied Equip. Co.
Wash., D. C., Paving Supply & Equip. Co.
Wash., Seattle, Star Machy. Co.
Wash., Spokane, Star Machy. Co.
Wash., Yakima, Star Machy. Co.
Wisc., Milwaukee, Drott Tractor Co., Inc.

Ransome Distributors

N. Y., Rochester, B-G Equip. Co.
O., Cleveland, H. B. Fuller Equip. Co.
Pa., Pittsburgh, Arrow Supply Company.

Worthington Distributors

Ind., Indianapolis, Reid-Holcomb Company

La., New Orleans, Wm. F. Surgi Equip. Co.

Md., Baltimore, D. C. Elphinstone, Inc.

O., Cleveland, Gibson-Stewart Co.
O., Columbus, Gibson-Stewart Co.

Pa., Pittsburgh, Atlas Equip. Co.

Texas, El Paso, Equip. Supply Co.

Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Blue Brute Engines

Worthington Pump and Machinery Corp.
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts

cylinder gasoline engine. Machine is applicable to pavement breaking, rock drilling, ground rod driving, driving sheathing, tamping, and clay digging. Three models weigh 78 to 96 lb.—*Marco Mfg. Co., 1801 Winnemac Ave., Chicago 40, Ill.*

413

Heavy Duty Trailers—(2-p. folder). Illustrations and specifications for single-axle and tandem-axle tilt trailers. Points out special features for transporting heavy construction equipment such as power shovels, tractors, mixers, etc.—*C. R. Jahn Co., Savanna, Ill.*

414

Flexible Couplings—(32-p. catalog). Deals with Morse Morflex flexible coupling line. Describes development of couplings, their construction and working principle. Capacities range from 0.06 to 13.80 hp. rating per 100 rpm. Radial coupling is designed to absorb heavy torque loads, shock and high-frequency load reversals.—*Morse Chain Co., 7601 Central Ave., Detroit 8, Mich.*

415

Safety Gratings—(12-p. pamphlet). Describes line of safety gratings for industrial and commercial use including also treads and steel trough stairs and other items of light steel work. Describes how gratings are made and flexibility of design to suit span and load conditions. Tabulations cover safe distributed loads and specifications.—*Dominion Bridge Co., Ltd., Lachine, Que., Canada.*

416

Bottom-Dump Wagon — (Leaflet). Heavy-duty earth moving Euclid rubber-tired bottom-dump unit has 25 cu.yd. capacity, struck measure and is powered by 275-hp. diesel engine. Top speed is 24.1 mph. Tire sizes are 14.00 x 24 front and 27.00 x 33 on drive and trailer wheels.—*Euclid Road Machinery Co., Cleveland 17, Ohio.*

417

Granite—(2-p. folder). Chelmsford white granite curving for highway, street and sidewalk projects. Various uses of granite are illustrated.—*H. E. Fletcher Co., 115 E. 40th St., New York 16, N. Y.*

418

Spiral Conveyor — 48-page catalog covers the application of a spiral conveyor, how to specify, horsepower formulas, etc. All the equipment conforms to new industrial standard dimensions.—*The Jeffrey Mfg. Co., Columbus 16, Ohio.*

Men and Jobs

Herbert Ensz, head of the testing and inspection section, Chicago Department of Subways and Superhighways, has resigned to become structural project engineer for Sargent & Lundy, Chicago. During an extensive and diversified engineering career, Mr. Ensz had been structural engineer on Chicago subway design and soils investigation for Charles E. De Leuw and Co.; engineer in charge of design for the Management and Engineering Corp. on the 800-ft. railroad suspension bridge at Boldman Ky.; and associate professor of civil engineering, Armour (now Illinois) Institute of Technology. He received B. S. in C. E. and C. E. degrees from the University of Colorado and an M. S. from Armour.

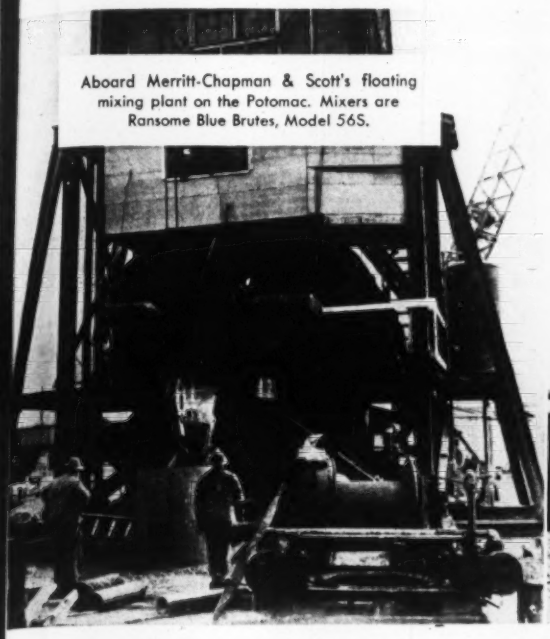
Gerald J. Fitzgerald has resigned as Public Works Commissioner of Utica, N. Y., to become general superintendent of Midstate Builders, Inc. **James Jones,** former contractor and builder, has been appointed his successor. Mr. Fitzgerald served since Jan. 1, 1946, and for 22 years before that he was an assistant engineer in the Utica department of engineering. A specialist in sewer construction and design, he supervised most of the sewer construction and a great deal of the paving work in Utica.

John Duff has been appointed commissioner of public works at Wenatchee, Wash., to succeed J. A. Goodfellow, who resigned recently after serving 11 years. Duff was resident engineer for the state highway department at Wenatchee for 15 years and previously had been Chelan County engineer, also at Wenatchee, for nine years.

Chester A. Hogentogler, chairman of the department of Soils Investigations of the Highway Research Board, has retired from the Public Roads Administration. He will be succeeded as chairman by Harold Allen.

Charles W. Kestner, who has been the Virginia State Highway Department resident engineer at King George Courthouse since July, 1946, has been promoted to personnel engineer of the department. He is being succeeded by **J. R. Thomas,** assistant resident en-

"FLOATING" BLUE BRUTES HELP BUILD NEW BRIDGE



Aboard Merritt-Chapman & Scott's floating mixing plant on the Potomac. Mixers are Ransome Blue Brutes, Model 56S.

Merritt-Chapman & Scott's "concrete fleet", showing the Blue Brute mixing plant and attendant barges.

Concrete for the piers of the new Washington-Alexandria bridge over the Potomac is being mixed on a unique floating batching and mixing plant employing two Ransome Blue Brute 56S Mixers. Merritt-Chapman & Scott, Contractors, combined a mixing and batching plant with a floating crane to keep the plant near the forms. Cement, sand, and aggregate are supplied from barges hauled to the plant, and mixed concrete is hoisted by floating crane to the forms.

Each one of these Blue Brutes is equipped with the new Ransome "power pack" — a small, compact unit containing the discharge mechanism's automatic hydraulic control, allowing one-man operation with a single hand-lever.

Other Blue Brute features for low-cost, trouble-free mixing are: Drum rollers turning independently on two Timken roller bearings . . . Steel drum-roller tracks . . . Roller shafts of heat-treated alloy steel . . . Ransome's exclusive mixing action, fast and thorough . . . Drum is equipped with renewable liners.

Get further facts on why Blue Brute Big Mixers are first choice of so many central mixing plants and top-flight contractors. See your nearby Worthington-Ransome Distributor, or write direct.

R8-4

KNOW YOUR

BLUE BRUTES

Your Blue Brute Distributor will be glad to show you how Worthington-Ransome construction equipment will put your jobs on a profitable basis. His name is listed on Page 136.

RANSOME EQUIPMENT

Pavers, Portable and Stationary Mixers, Truck Mixers, and Accessories.

WORTHINGTON EQUIPMENT

Gasoline and Diesel Driven Portable Compressors, Rock Drills, Air Tools, Self-Priming Centrifugal Pumps and Accessories.

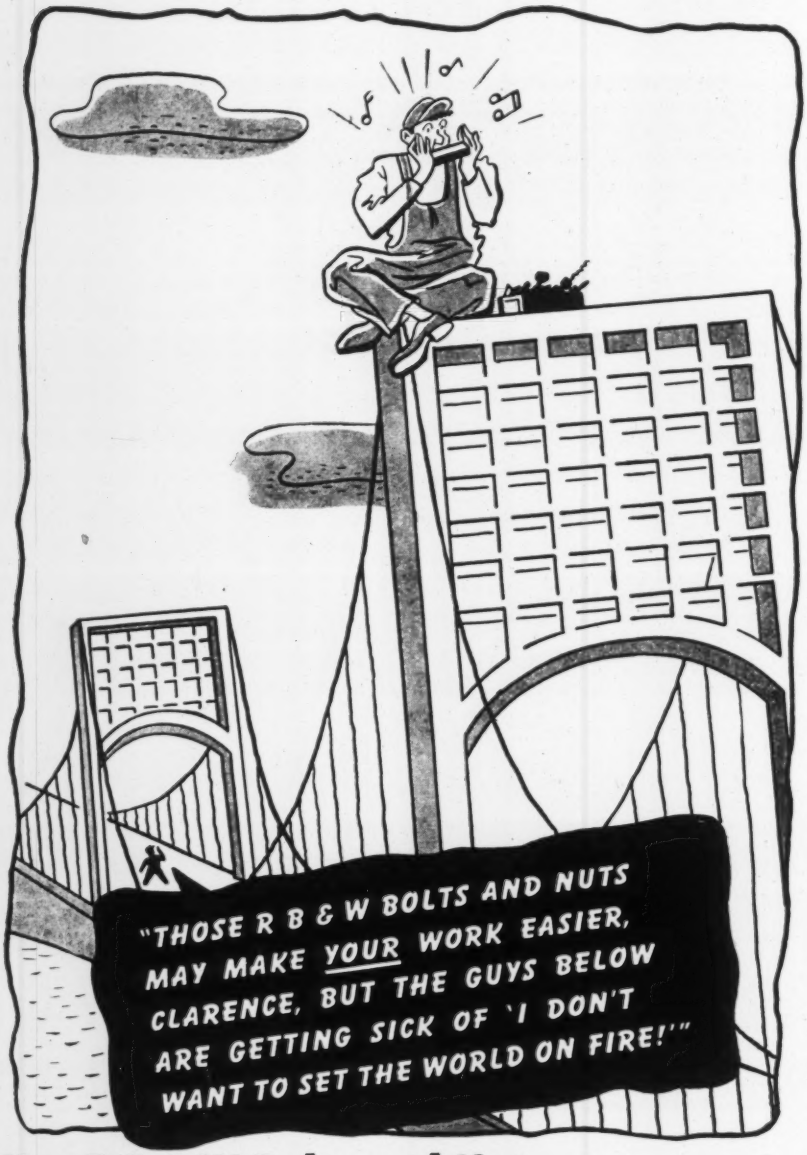
WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Mass.

Distributors in all principal cities

BUY BLUE BRUTES

IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB


"THOSE R B & W BOLTS AND NUTS
MAY MAKE YOUR WORK EASIER,
CLARENCE, BUT THE GUYS BELOW
ARE GETTING SICK OF 'I DON'T
WANT TO SET THE WORLD ON FIRE!'"

Use R B & W Bolts and Nuts . . .

Quick-starting, quick-tightening because they are accurately, uniformly sized and threaded — and carefully inspected.

Vibration-resisting, shock-resisting because the manufacturing method insures extra strength, and all processing is controlled from raw rod to finished product.

EMPIRE BOLTS NUTS-RIVETS AND ALLIED FASTENING PRODUCTS . . . SINCE 1845

RB&W *Making strong the things that make America strong*

Russell, Burdsall & Ward Bolt and Nut Company. *Factories at* Port Chester, N. Y., Rock Falls, Ill., Coraopolis, Pa., Los Angeles, Calif., *additional sales offices at* Philadelphia, Chicago, Detroit, Chattanooga, Oakland, Portland, Seattle

gineer at Lexington. **George H. Gill**, survey party chief in the Richmond district, has been transferred to Lexington. Kestner succeeds **Francis A. Davis,** who was appointed to succeed the late William Wilson McClevy as purchasing agent of the department. The new personnel engineer is an alumnus of Emery and Henry College and Valparaiso University. Thomas attended Virginia Military Institute.

George D. Waddill will retire June 30 after more than 50 years of government service. A pioneer in river engineering, he joined the Corps of Engineers in June, 1897, after he got his bachelor of science degree in engineering and mechanics at Louisiana University. About 46 years of his service was in what is now the New Orleans district of the Corps of Engineers. In 1943 he was transferred to the Mississippi River Commission, where he has worked on bank revetment.

Lieut.-Gen. Eugene Reybold, U. S. Army, retired, who until recently was engineer in charge of the Delaware River crossing division of the Delaware State Highway Department, has gone with the Lustron Corporation, manufacturers of prefabricated all-steel porcelain enemeled houses, in Columbus, Ohio. General Reybold, former chief of the Army Engineers, will be vice-president in charge of operations.

Brig. Geoffrey Walsh, St. Catherines, Ont., and formerly chief engineer of the Northwest highway system, has been named commandant at the Kingston Military Zone.

William C. Parks, of Greensboro, N. C., has been named an engineering aide with the municipal public works department at Greensboro. For the last seven years he has been in ordnance maintenance work with the Navy.

Donald N. Becker, has resigned after 36 years of service for Chicago, the last 24 of which were as engineer of bridge design during which he had full charge of the design of upwards of 20 movable bridges, and of several fixed bridges and viaducts. He is now chief structural engineer with A. J. Boynton & Co. of Chicago. That firm specializes in engineering service and technical counsel on industrial buildings and equipment.

Elections and Activities

Dean Curtis L. Wilson, of the Rolla School of Mines has been elected chairman of the Missouri section of the American Society for Engineering Education. R. L. Scorah was elected vice-chairman and John W. Hubler, secretary.

Officers of the Concrete Reinforcing Steel Institute for 1948-49 are: H. E. Calves, president; E. B. Wilkinson, vice-president; W. H. Stewart, vice-president; J. R. Fenstermaker, treasurer; and H. C. Delzell, secretary. New directors are: F. H. Davidson, J. R. Fenstermaker, S. V. Taylor, and F. F. Trierweiler.

R. E. Setterstrom, Butte, Mont., has been elected president of the Montana Society of Engineers. Also elected were E. A. Champ, Butte, first vice-president; E. A. Barnard, Anaconda, second vice-president; R. D. Piper, Helena, secretary-treasurer, and F. C. Homann, Bozeman, and E. C. Shevalier, Great Falls, trustees.

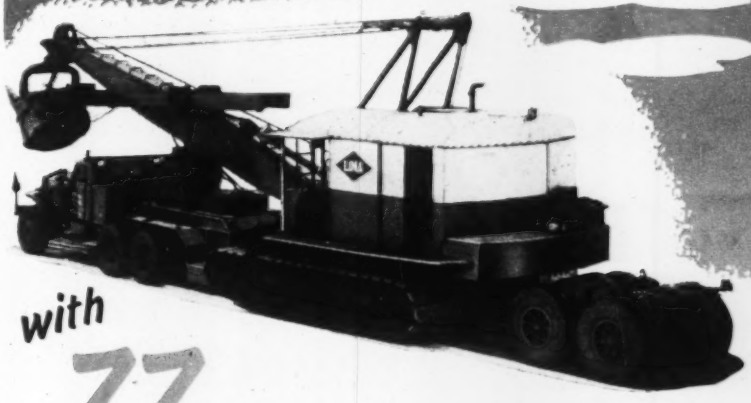
K. H. Spies, associate Oregon state sanitary engineer was elected president of the Northwest Sewage Works Association in a convention at Boise, Idaho. Emil C. Jensen, chief of the division of public health engineering of the Washington state health department, was named first vice-president and W. P. McNamara, sewer maintenance engineer of Seattle, Wash., second vice-president. C. M. Howard of Seattle was re-elected to the board of control and William P. Hughes, city engineer of Lewiston, Idaho, was reelected secretary-treasurer.

G. I. Thurmond of Enka, N. C., has been elected president of the Engineers Club of Western North Carolina, succeeding Guy White, Jr. Other new officers are: E. O. Bryant, vice-president; V. M. McLary, secretary; Albert Goodwin, treasurer; and M. G. Lyon and Walter H. Bearden, directors.

At a recent meeting of the American Public Power Association held at Colorado Springs, Colo., Major Thomas Allen, president of water, gas, and electricity for the city of Memphis, Tenn., was elected association president. Samuel B. Morris, general manager and chief engineer of the Los Angeles, Calif., Department of Water & Power, was elected vice-president.

'DUCKING BRIDGES'

Photo Courtesy Weston Hauling, Inc., Glenshaw, Pa.



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Manufacturers' Activities

Current developments among manufacturers relating to expansion of services, shifts in personnel, and other changes, include the following:

Sales—Mervyn W. Martin has been appointed sales representative of the MARION POWER SHOVEL Co. in California and Nevada . . . Kent L. Wilson has been promoted to manager for the southwest region of the MINNEAPOLIS-HONEYWELL REGULATOR Co. with headquarters in Dallas, Tex. Succeeding Wilson at Detroit, Mich., is T. S. Carley. Walter J. Baak is now sales manager of the wholesale division. G. M. Kingsland heads sales of the stoker controls division, and W. S. Robards has been appointed Milwaukee, Wis., branch manager . . . Harry E. Madsen has been named to the Chicago district sales staff of CECO STEEL PRODUCTS CORP. . . . NEW JERSEY STEEL Co. is distributor for PLASTEEL PRODUCTS Co. in the Camden, N. J., area . . . Ventilator division of the SWARTWOUT Co., Cleveland, Ohio, has appointed George R. Mellema Co. as Minneapolis, Minn., representative . . . Harry R. Powers has been appointed eastern sales manager of R. G. LETOURNEAU, INC., to succeed E. M. Ferguson, resigned . . . John H. Huston has been appointed Michigan sales representative for the RICHKRAFT Co., Chicago . . . Robert Moran has been appointed manager of industrial tire sales of the GENERAL TIRE & RUBBER Co. . . . James W. Bampton is in charge of an East Coast office of PRESSTITE ENGINEERING Co., St. Louis, Mo., in the Times Medical Bldg., Philadelphia, Pa., and Harry A. Lowry has opened a West Coast sales office at 5,960 Willowcrest Ave., North Hollywood, Calif. . . . James J. Ryan has been appointed to the newly-created position of manager of gypsum, lime and steel products for the NATIONAL GYPSUM Co. . . . James H. Lahey will direct York-Heat automatic heating equipment sales in the middle western territory for YORK-SHIPLEY, INC.

Personalities—George J. Hummel has been named marketing manager of the Stamford, Conn., division of THE YALE & TOWNE MFG. Co. . . . D. R. Anderson is now manager of the Hibbing, Minn., branch office of THE EUCLID ROAD MACHINERY Co. J. M. Fairbanks has been made service manager in place of Mr. Anderson . . . THE AMERICAN IRON and STEEL IN-

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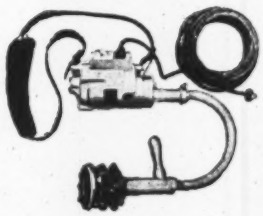
CONCRETE SURFACER
MODEL A



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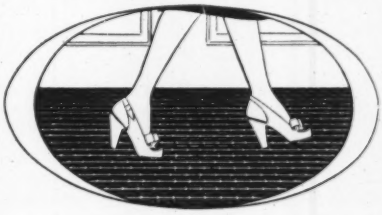

No object over ½ square inch can pass through super-safe U-Type Tri-Lok Flooring. Fabricated without bolts, rivets or welds, it is unsurpassed for plant installation, walkways, loading platforms. Efficient distribution of concentrated loads . . . maximum free opening for light and air. Write for Bulletin JX 1140.

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STITUTE medal has been awarded to J. L. Manthe, vice-president of THE YOUNGSTOWN SHEET and TUBE CO. and to Karl L. Fetters of the same company, and post-humously to the late J. H. Slater of the REPUBLIC STEEL CORP. . . . Wayne J. Holman, Jr. has been named vice-president and general manager of CHICOPEE SALES CORP. . . . Sol. B. Rosenfeld has been appointed field manager of the building products division of L. SONNEBORN SONS, INC., New York City . . . William L. Batt, president of SKF INDUSTRIES, INC., has been made an honorary companion of the Order of St. Michael and St. George in recognition of his wartime work in co-ordinating production among the United States, Canada and Great Britain . . . Reese B. Lloyd, formerly at the RHEEM MFG. CO.'s plant in Chicago has been made manager of plants with headquarters at South Gate, Calif. . . . Luke E. Sawyer has been elected executive vice-president and a director of THE BABCOCK & WILCOX TUBE CO. . . . A. William McGraw has been appointed MARION POWER SHOVEL Co. representative in sections of Missouri, Illinois and Kentucky . . . Walter P. Barrett has been made manager of the New York district office of DBAVO CORP., Pittsburgh, Pa.—at 30 Church St. . . . Walter Geist has been elected to his seventh term as president of the ALLIS-CHALMERS MFG. CO.

Deceased—Earl D. Jones, with the GEO. F. SMITH CO., INC., construction and industrial equipment, St. Louis, Mo., for 25 years, died May 17 . . . James Alfred Malarkey, 75, founder of M. and M. WOOD WORKING CO., Portland, Ore., died in that city May 3.

Miscellany — BAILEY METER CO., Cleveland, Ohio, has opened a new branch office in Charlotte, N. C., with J. R. Powell branch manager . . . The construction materials department, a new operating department of the GENERAL ELECTRIC CO. has been established, with C. D. Hepler, general manager, headquarters at Bridgeport, Conn. . . . Dump truck bodies are now being made at the newly-established division of GAR WOOD INDUSTRIES, INC. at Richmond, Calif., where James B. Steed is division manager . . . Complete warehouse facilities for THE SISALKRAFT CO. have been established at Railway Warehouse, Inc., 3540 Craton Ave., S.E., Cleveland, Ohio . . . It is expected that new facilities at the Tampa, Fla., plant of GENERAL PORTLAND CEMENT CO. will enable the Florida division to produce about 3,000,000 bl. of cement a year . . . BUCYRUS-ERIE CO., South Milwaukee, Wis., announces that it has acquired ownership of the MILWAUKEE HYDRAULICS CORP., 7923 W. Greenfield Ave., Mil-

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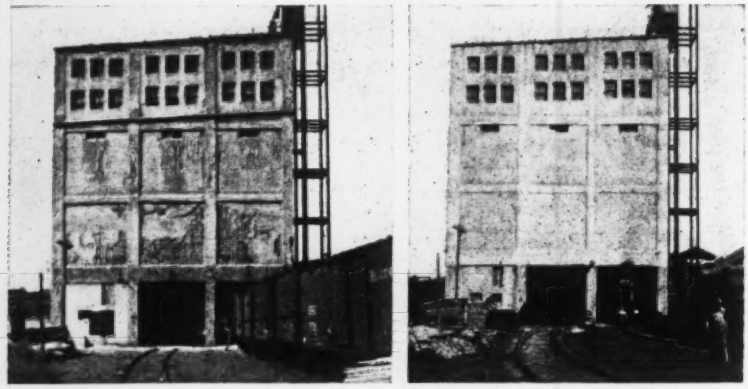

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waukee, from R. O. Billings, the principal stockholder. The Hydraulic Corp., manufacturers the Hydro-Crane, truck-mounted hydraulically-operated crane. BUCYRUS-ERIE has acquired the drawings, designs, and patent rights from Billings, who invented the device, according to N. R. Knox, president of Bucyrus-Erie.

Correction—At the end of the Miscellany column in a recent issue an editorial mixup included a CATERPILLAR TRACTOR CO. item in an R. G. LE TOURNEAU, INC., notice. The movie mentioned, "Material on the Move", is issued by the CATERPILLAR CO., and may be obtained through the Peoria, Ill., office or through Caterpillar distributors.

New Engineering Books

(*Continued from p.* 112)

SAMPLING INSPECTION—By statistical Research Group, Columbia University. 737 pp. McGraw-Hill Book Co., New York 18, and London. $5.25.

ECONOMICS: AN INTRODUCTORY ANALYSIS—By Paul A. Samuelson. 622 pp. McGraw-Hill Book Co., New York 18, and London. $4.50.

FUNDAMENTALS OF ECONOMICS—By M. H. Umbreit, E. F. Hunt, and C. V. Kinter. 461 pp. McGraw-Hill Book Co., New York 18, and London. $3.75.

FUNDAMENTAL PRINCIPLES OF BACTERIOLOGY—Third Edition—By A. J. Salle. 730 pp. McGraw-Hill Book Co., New York 18, and London. $6.

AN INTRODUCTION TO THE PHYSICS OF METALS AND ALLOYS—By W. Boas. 193 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $3.50.

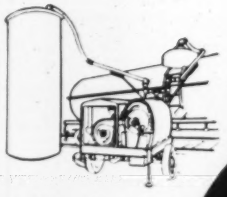
LIGHTING DESIGN—By Parry Moon and Domina E. Spencer. 482 pp. Addison-Wesley Press, Kendall Square, Cambridge 42, Mass. $5.

Reports and Pamphlets

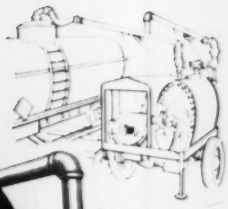
AAA PROGRAM OF ACTION FOR 1948—American Automobile Association, Pennsylvania Avenue at 17th St., N.W., Washington 6, D. C.

STATEMENT OF HIGHWAY NEEDS FOR A PROPOSED LONG RANGE ROAD PROGRAM—Oklahoma Department of Highways, Capitol Office Building, Oklahoma City 5.

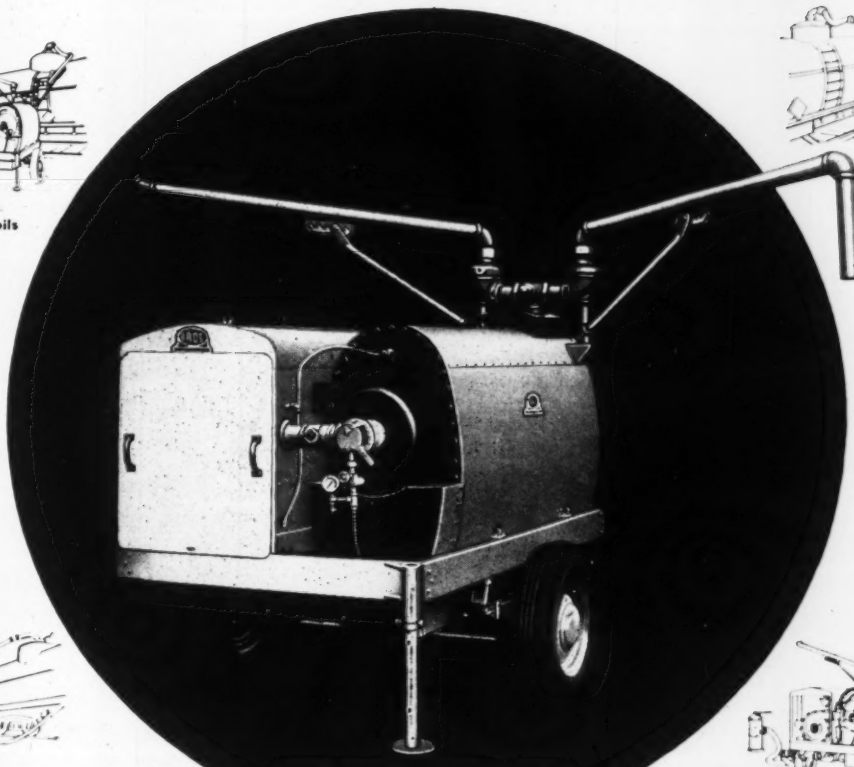
BETTER HEATING BEYOND THE RANGE OF STEAM

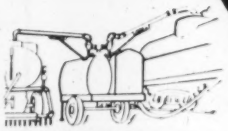


Heating and pumping heavy oils from tank car to storage tank

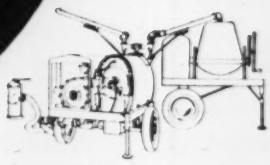


Heating and circulating oil through tank car for unloading





Heating and pumping oils from tank car to distributor



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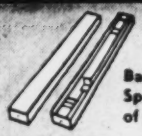

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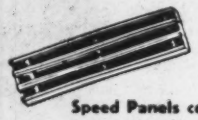

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FLEXIBLE PAVEMENT DESIGN—Technical Bulletin No. 119. American Road Builders' Association, 1319 F. Street, N. W. Washington 4, D. C.

REPORT OF COMMITTEE ON CONCRETE PAVEMENT DESIGN—Technical Bulletin No. 121. American Road Builders' Association, 1319 F. Street, N. W., Washington 4, D. C.

DESIGN AND CONSTRUCTION SUBBASES—SUBBASES FOR RIGID TYPE PAVEMENTS—Technical Bulletin No. 122. American Road Builders' Association, 1319 F. Street, N. W. Washington 4, D. C.

REPORT OF THE COMMITTEE ON MASS TRANSPORTATION—Technical Bulletin No. 134. American Road Builders' Association, 1319, F. Street, N. W., Washington 4, D. C.

REFUSE DISPOSAL PRACTICE: A BIBLIOGRAPHY—No. 3—Compiled by Joint Reference Library for the American Public Works Association, 1313 E. 60th St., Chicago 37, Ill. $1.

DIVISIONS AND PRICE LIST—Subject covered by the index card service of the Engineering Index Service, 29 W. 39th Street, New York 18.

PRICE LIST—American Standards Association, 70 E. 45th Street, New York 17.

FILING SYSTEMS FOR ENGINEERING OFFICES—Engineering Societies Library, 29 W. 39th St., New York 18. $2.

LOCAL FLOODS IN OHIO DURING 1947—Bulletin No. 14—By Wm. P. Cross. State of Ohio Dept. of Public Works, Ohio Water Resources Board, Columbus, Ohio.

PUMICE AS A LIGHTWEIGHT AGGREGATE—By F. Sommer Schmidt. Pumice Aggregate Sales Corporation, 121 South Yale, Albuquerque, New Mexico.

NEW PRINCIPLES IN URBAN TRANSPORTATION ECONOMY—Second Edition—The Transportation Problem in the City of Buenos Aires. Minister of the Interior, Buenos Aires, Argentina.

DESIGN OF FLEXIBLE PAVEMENTS USING THE TRIAXIAL COMPRESSION TEST—Report by the State Highway Commission of Kansas. Bulletin No. 8—Highway Research Board, Washington 25, D. C.

THE STUDIES OF HIGHWAY SKEW SLAB-BRIDGES WITH CURBS—Part I: Results of Analyses—Bulletin Series No. 369—University of Illinois, Urbana, Ill. $.75.

RATE OF PROPAGATION OF FATIGUE CRACKS IN 12-INCH BY ¾-INCH STEEL PLATES WITH SEVERE GEOMETRICAL STRESS-RAISERS—Bulletin Series No. 371—By Engineering Experiment Station, Uni-

This Giant

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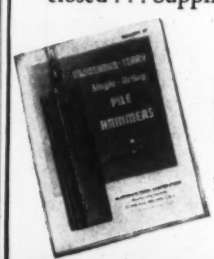

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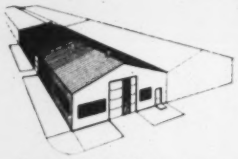
LURIA STANDARD BUILDINGS



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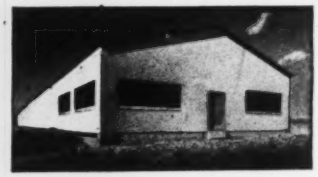

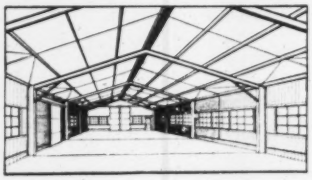

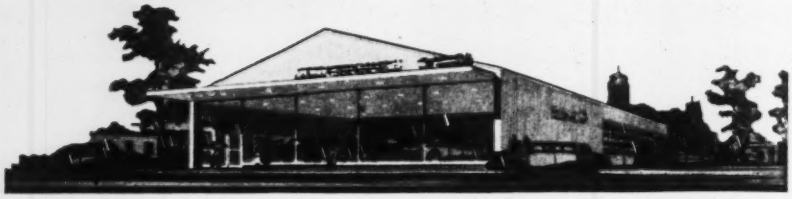

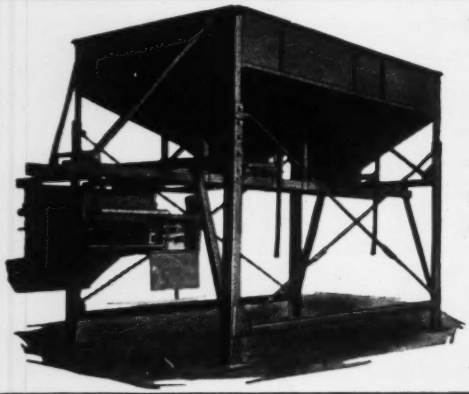

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